HANDBOOK OF

BRITISH HEPATICÆ

CONTAINING DESCRIPTIONS AND FIGURES OF THE INDIGENOUS SPECIES OF MARCHANTIA, JUNGERMANNIA, RICCIA, AND ANTHOCEROS

BY

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WITH 7 PLATES AND 200 WOODCUTS

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PREFACE.

THE splendid monograph of "British Jungermanniæ" published by Sir W. J. Hooker, in 1816, was the first independent work on the Hepaticæ published in this country, although many species were figured in Smith and Sowerby's English Botany, 1790-1814. After that time no attempt was made at the publication of a separate work until 1865. During the interval the Liverworts were included in general Floras, such as Hooker's English Flora, Vol. V., in 1833, but notably in Gray's Arrangement of British Plants in 1821, and in the latter several new genera were proposed, which were wholly ignored down to most recent times. In the year 1865 a small and unpretending little work was issued under the title of "Science Gossip; easy guide to the study of British Hepaticæ," which included brief descriptions of all the species known to date,

illustrated by wood-cuts. This was little more than an illustrated catalogue, but was the only complete work published down to the present. At that time the announcement was made of the speedy publication of "British Hepaticæ," with coloured plates, by Dr. Carrington, to be issued in four parts, which were ultimately published, but did not contain more than one-third of the British species known, and the work abruptly closed. Notwithstanding that the group is a small one, with other attractions for students, no manual for their use was to be found in the English language, except the above-named illustrated catalogue of nearly thirty years ago, and I have often been urged to expand that "easy guide" into a "Hand-book," and render it more complete and efficient, but I had always hoped that Dr. Carrington would complete his work, or issue an independent volume which should be complete in itself. These hopes having failed, with the death of my lamented friend, I have, at length, with some reluctance, prepared the following pages for the press. I have felt diffidence, since for many years another branch of the Cryptogamia has absorbed so much of my

time and attention, that I have been unable to collect and study the Hepaticæ in the field, and therefore have to be content with the chronicle of the labour of others rather than my own. It is acknowledged, on all hands, that such a Handbook is urgently required, and if it should be the means of increasing the number of students, or assisting those who have already commenced the study of these interesting plants, it will justify the publication.

M. C. Cooke.

HANDBOOK

OF

BRITISH HEPATICÆ.

INTRODUCTION.

THE Hepaticæ, or Liverworts, have always been regarded as closely related to the Mosses, and in olden times were associated with them. In constituting his alliances Lindley united them in his Muscal Alliance, and this has since been maintained, although there is sufficient distinction between them to be recognized by the naked eye. The most prominent and popular distinctions are that, in the Hepaticæ the capsule, or spore-bearing apparatus, splits when mature into four valves; whereas in the Mosses the capsule remains entire, and is closed by a lid, or operculum, which falls away to permit of the escape of the spores. This is a general character to which on both sides there are some exceptions, since some few of the Hepaticæ are devoid of a four-valved capsule, and amongst Mosses the Andreaceæ possess a valvular capsule. In another aspect, that of vegetation, a difference is also recognized, in that the Mosses are foliaceous, possessing a stem and leaves, whereas the Hepaticæ are most commonly foliaceous, but

sometimes frondose—that is to say, the stem and leaves are combined in a flat prostrate frond, which lies flat upon the matrix. The foliaceous Hepaticæ moreover have their leaves of a thinner and more delicate substance, and are destitute of a distinct central midrib. Finally, the Hepaticæ usually contain within the fruit capsule, intermixed with the spores, elongated spiral fibres, called *elaters*, which are absent from true Mosses. These are the most evident general distinctions which are relied upon in the discrimination of the two groups.

The entire group of Hepaticæ are subdivided into four natural orders, which have each their peculiar character. These are the *Marchantiaceæ*, which are frondose, and have the sporangia disposed on the under side of stalked receptacles, the spores being mixed with elaters; this is accepted generally as the highest order of Liverworts. Then follow the *Jungermanniaceæ*, in which the fruit is pedunculate and solitary, the sporangium when mature splitting into four equal valves, and the spores mixed with elaters. After these are the *Ricciaceæ*, the species of which are frondose, with the sporangia sunk into the substance of the frond, or borne upon the surface, and the spores unmixed with elaters. Finally the *Anthocerotaceæ*, in which, although the vegetation is frondose, the sporangium is exserted and erect, splitting longitudinally on one or both sides, and exhibiting a thread-like central columella. The elaters, when present, elementary and imperfect. Of all these the most abundant in species is the *Jungermanniaceæ*, which includes far more than the

other three orders together, and has come to be regarded as the type of the *Hepaticæ*.

It is difficult to estimate the number of known species distributed through the world, since the latest "Synopsis" is now fifty years old. In 1847 the total stated by Lindley was seven hundred, but at the present day it cannot be estimated at less than two thousand, and possibly more, of which two hundred have been found in the British Isles. When it is remembered that Dr. Spruce records about five hundred and sixty species for the Amazon and Andes, of which but few are European, it must be conceded that our estimate is the lowest which could be accepted.

The habitats mostly favoured by the *Hepaticæ* are, for the most part, damp rocks, within the spray of waterfalls or mountain torrents, on damp soil, in bogs, on old trunks, and often intermixed with *Sphagnum* and mosses generally. Some are so minute as to be just visible to the naked eye, whilst others attain to several inches, and like the mosses, usually flourish in tufts or effused patches, often of many inches in extent. Whilst the true mosses are for the most part of a bright and lively green, the *Jungermanniæ* at least are more seldom of a bright green, but have a wide range of colour from silvery grey, and glaucous, through olive and brown, not uncommonly tinged more or less deeply with purple or rose, and at times nearly black.

Hepatics do not retain their form or colour so well in drying as do the mosses. The thin leaves shrivel, curl, and collapse, and sometimes become

very fragile. When placed in water they recover their form to some extent, but the fugitive colour never returns; nevertheless they retain their distinctive specific characters, so that there is no difficulty in their determination after the lapse of many years. Although inferior to Mosses and Lichens in bearing the process of desiccation, they are at the same time superior to the fresh-water algæ and fungi. What is true of other plants is also true of these—that in order to their complete and accurate determination the fructification is essential. When specimens are collected they should be gathered with their fruit if possible, although there are some species of which the perfect fruit is very rare; and a few in which the mature capsules have never been found in this country. We do not deny that the experienced hepaticologist would in many cases determine a known species accurately, from other characters, in the absence of fruit when the student would fail.

The relations of the Hepatics with the Mosses have been the subject of comment by Dr. S. O. Lindberg,* an eminently capable authority, who says that the Mosses are superior to the Hepaticæ only in regard to the more composite structure of their theca, and the presence of a nerve in their leaf, but in all other respects they seem to be inferior. To which he adds that the Hepaticæ are superior to the *Bryineæ* chiefly by the following characters: The polymorphy of all their organs;

*Lindberg on Zoopsis, in Linn. Journ. Bot. XIII., p. 196, 1873.

the spore gives rise to only a single plant; their protonema is short, usually thick, and very little or not at all branched We need not follow him through the more extended remarks which he offers in support, and his conclusion that the Liverworts seem in their relation to the Mosses to remind us a little of the Dicotyledonous plants in their relation to Monocotyledons. The first and best developed family of Hepaticæ is, he thinks, *Marchantiaceæ*, with its highest type *M. polymorpha;*" and he adds that "the *Anthocerotaceæ* must be placed at the end, because their oogonium is naked, and their frond and elaters show a very low grade of development, although they possess a columella, and stomata on the outside of the theca, which two organs are very characteristic, and are vainly to be searched for in the other families of Liverworts.

Vegetative System.

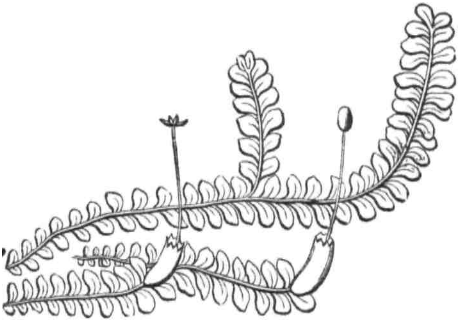
In general terms it may be said that the Hepatics follow two types in their vegetation, they may be frondose as in *Marchantiaceæ*, *Ricciaceæ*, and a few *Jungermanniaceæ*, and then there is a superficial resemblance to Peltigerous Lichens, or they are foliaceous, as in the majority of the *Jungermanniaceæ*, and then they resemble mosses; but in both cases the resemblance is rather superficial than real. In some instances the stem is not wholly obsolete but is fused with the leaf-like expansions into a prostrate frond, being manifested by a

central nerve, more or less defined, which is the axis of the frond (fig. 1). These fronds lie flat upon the matrix, or in a few cases are floating, and are attached by delicate radicles proceeding from the under surface, which may be quite smooth, or scaly, or more or less hairy. Sometimes the fronds are deeply and intricately lobed, and at others nearly simple, or notched at the apex. Occasionally solitary, but more usually radiating, overlapping, and forming imbricated tufts. In rare instances the upper surface of the frond is punctate with minute pores, which are the analogues of stomata in the higher plants.

1.

The foliaceous Hepatics have a thin thread-like stem, which is so weak that the plants are only erect when growing in dense tufts, or mixed with *Sphagnum* or other mosses, the lower portion being mostly naked or only furnished with radicles. Upwards the stem is forked or branched, and the branches themselves sometimes pinnate; occasionally it is normally simple. The stems being so often prostrate the arrangement of the leaves is in two rows, on opposite sides of the stem, but inserted more or less obliquely, so as to lie nearly flat, in prostrate forms (fig. 2). The leaves are exceedingly variable in outline, seldom so simple as in mosses, and without any mid-rib or nerve. In

many cases they consist of two unequal lobes, folded together face to face, with the margin



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either entire or toothed. The arrangement of leaves on the stem may be succubous, or disposed in a spiral which turns from left to right, so that the anterior border of each inferior leaf is covered by the posterior border of that immediately above Or the arrangement may be incubous, in which case the spiral turns from right to left, and the anterior border of each inferior leaf covers the posterior border of the leaf placed immediately above it. If one of these stems is examined carefully on both sides with a lens, it will be observed that they differ much in appearance, and especially that the under, or ventral, surface exhibits a series of smaller leaves, some-

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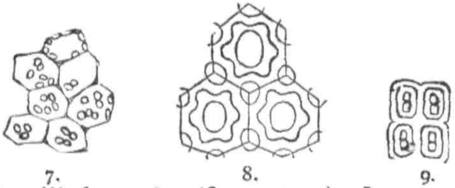
times very small, attached to the stem at more or less regular distances, which are termed *amphigastria*, or stipules (figs. 3 to 6). Sometimes they may resemble the true leaves in miniature or they may be totally different, and occasionally they are absent altogether. Mixed with the stipules, on the ventral surface, delicate unicellular radicles will often be observed, which assist in fixing the Hepatic to its matrix or the mosses with which it is intermixed. Theoretically three rows of leaves are present, two lateral, or true leaves, and one ventral, the stipules or amphigastria, the radicles may be regarded morphologically as modified leaves.

The leaves, whether normal or stipular, are thin simple plates, of a single series of cells, without any distinct central nerve. These cells vary, within certain limits, in different species, such variations being sometimes useful in the discrimination of



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closely allied species (figs. 7 to 9). In some cases these cells project on the margin of the leaves and impart a crenulate or minutely serrulate appearance. In such a case as that of *Scapania aspera* the external surface of the cells is delicately warted, and this roughness is especially evident in *Lejeunia Rossettiana*. It is only rarely that they are punctate or perforate.

The germination of the spore in mosses produces at first a thread-like protonema, which might be mistaken for a conferva, upon which buds are developed, and these are the rudimentary moss-plants. In the Hepatics there is commonly a less distinct protonema. In frondose or thalloid *Jungermanniaceæ* a lamina is formed, from which the frond is produced, or, in some of the foliaceous species, a ribbon of cells passes into a stem and leaves; or, in other cases, the stem bud proceeds direct from the spore, whilst in some cases there is a proper protonema. In *Radula* for instance there is a well-defined body of a cake shape, which sends out rootlets from beneath, and ultimately, five months after sowing, a bud at the margin indicates the commencement of growth of a young plant. This developes gradually by apical growth into stem and bilateral leaves.

The modification which the leaves undergo as they approach the reproductive organs, and become converted into bracts, may be alluded to further on.

There are two methods by which the species may be perpetuated, independently of ordinary fructification. This is accomplished, as the stem dies off behind, by the branches becoming disconnected and independent, and, in the frondose species, by adventitious frondlets becoming similarly detached and forming new plants. The other method is by gemmation. Cells will sometimes detach themselves from the margin of leaves, as gemmæ, or buds, and grow independently. In other cases the

process is more elaborate and can be studied readily in *Marchantia*. Cup-like bodies, seated upon the fronds and exposed to the light, will be seen to contain minute rounded greenish granules, like eggs in a miniature bird's nest. These little granules are the swollen apical cells of the slender filaments which have grown from the bottom, and they ultimately fall out as gemmæ. On reaching the ground, or other substratum, they germinate and become young plants.

REPRODUCTION.

The reproductive process and organs vary not only in the different orders but to a certain extent in the different genera; it will, nevertheless, be possible to furnish such general information as may assist in the comprehension of particular phenomena as they may arise. The foliose Jungermanniæ will serve as the best illustration for this purpose, and here the reproductive organs generally occupy the end of the primary axis, or special lateral branches. It will be found in most cases that the ordinary cauline leaves increase in size gradually towards the apex. Almost as gradually, in fertile shoots, do they merge into the enlarged and modified leaves, which constitute the *involucre*, or *perichætium*, of the fruit-bearing receptacle. These involucral bracts, or perichætial leaves, vary in size and number as well as in form, and may be either free or connate at the base, more or less embracing the *perianth* or *colesule* (sometimes inaccurately termed the calyx) enclosing

the fruit. The last pair, or more, of leafy expansions immediately beneath the perianth, whatever their form, are the perichætial leaves or bracts. Within these are to be found the *archegonia* or, as sometimes called, the *pistillidia*, indefinite in number, perhaps three, or as many as ten, of which only one or two are fertilized and develope into the perfect fruit. The archegonia, therefore, are the young female organs of reproduction, and arise usually from the apical cell of the axis or in close proximity thereto. After the appearance of the archegonia a simple cellular ring indicates the commencement of growth of the colesule or perianth, which is always subsequent to the formation of the archegonia. When the colesule is developed it encloses the fertilized and the sterile archegonia with all their subsequent appendages.

Passing over the intervening period we arrive at the time when the colesule, or perianth, is fully developed and half emergent from the perichætial leaves (as in fig. 10), with an apiculus at the apex or wholly emergent from a whorl of bracts (as in fig. 11) and toothed at the apex. We need not advert here to the various modifications of this perianth or colesule, which is often plicate, or angular,

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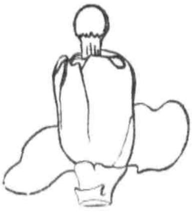
or keeled, and may, or may not, be toothed or fringed at the mouth. At this time it encloses the fertilized archegonium, now developed into a sporogonium, with a rudimentary pedicel, which is enclosed within a membrane, attached at the base and pointed at the apex, called a *calyptra*. This is not to be confounded with the hood, or calyptra, in mosses, which is torn away at the base and carried up, like a cap or extinguisher, on the top of the capsule. In Hepatics the calyptra remains fixed at the base and is ruptured at the apex, leaving the fragments behind, in the perianth, surrounding the base of the fruit stalk. With the rupture of the calyptra the sporogonium is forced upwards by the growth of its peduncle, and appears above the perianth as a globose head (fig. 12), which soon



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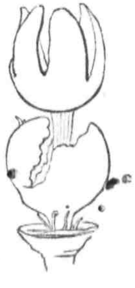

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splits, in a stellate manner, into four segments or valves (fig. 13), leaving the remains of the calyptra

behind (as is shown in fig. 14, where the perianth is removed). In some genera where the colesule, or perianth, is entirely or almost obsolete, as in *Metzgeria*, the calyptra is more highly developed, and covered with rigid hairs (fig. 15). As the capsule rises on its own peduncle it encloses within itself the mature spores, mixed with spiral fibres, and when the splitting takes place the spores are discharged, together with some of the elaters, whilst others remain attached to the valves (figs. 17, 18). The exterior surface of the four-valved capsule is often beautifully striate, longitudinally and transversely (fig. 16).

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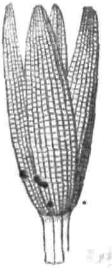
The *elaters* are elongated fusiform cells, with from one to three spiral fibres coiled around the inner wall. In some species the outer membrane is so



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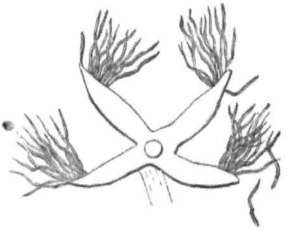

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delicate that it cannot be distinguished, but Gottsche was of opinion that in all cases there was primarily a cell membrane, within which the spirals of the elaters were turned, although in some species it is

actually dissolved, or is extremely transparent. In most cases the spiral is double, but rarely single, a portion of them fall away with the spores, whilst others remain attached to the valves. The old notion that their function was to aid in the dispersion of the spores does not seem to be supported by evidence. "In some genera a few of the apical elaters, and in others a few of the basal ones, persist for some time after the bursting of the capsule, and retain a good many of the free elaters entangled in them, but finally fall away. These elater-holders, as they have been called, are usually (but not always) shorter and wider than the free elaters, and do not generally agree with them in the number of included spirals." In *Anthoceros* the elaters are transverse rows of cells without spiral bands. The structure and development of the elaters in *Marchantia* were investigated by Professor Henfrey and made the subject of an elaborate memoir.

The male inflorescence consists of antheridia which are developed in various ways. The antheridium itself consists of a globose, or ellipsoid, body surmounting a rather short pedicel. In the foliose *Jungermanniecæ* they generally occupy the axils of leaves, either singly or in groups. The body of the antheridium encloses within it the mother cells of the antherozoids, which escape on the access of water, and then separate, the antherozoids becoming free. The free antherozoids resemble curved threads, wound spirally from one to three times, provided at one end with a pair of long and

very fine cilia, by means of which the antherozoids rotate in water. It may be observed that some authors apply the name of *spermatozoids* to the same bodies as are here called *antherozoids*. The male inflorescence, in its entirety, is called *andræcium*, and the bracts, or modified leaves, will probably be larger than the ordinary leaves. A good example of this will be found in *Jungermannia Pearsoni*.

As already intimated, there are certain modifications of the above general remarks on reproduction to be found, not only in the other orders, but also in the thalloid or frondose *Jungermannieæ*. Of these we can only allude to one or two of the more important.

In *Marchantiaceæ* the vegetation is frondose, and special stalked receptacles have the antheridia immersed in the upper surface. The female receptacle is also stalked, the expanded apex being variously lobed, and the archegonia are produced on the under surface. Most of the other details are modified in the different genera.

In the *Ricciaceæ*, which are also frondose, and sometimes floating, the reproductive organs are produced on the upper surface. The antheridia are immersed in the substance, showing but a slight conical elevation above them. The archegonia are also imbedded; and very simple in their character, they project at first, and when fertilized, the globose sporogonium becomes packed with

spores without elaters, and with the decay of the surrounding tissues the spores are dispersed.

In the *Anthoceroteæ*, the flat thallus, or frond, consists of several layers of cells, and in this the antheridia are immersed. When the antherozoids are mature the apex of the cavity is ruptured, and they escape. In a similar manner the archegonia commence in the substance of the frond, and after fertilization the spore-bearer or sporogonium elongates, rising above the surface of the frond nearly an inch, with somewhat the shape of a pod or siliqua, which splits downwards into two valves exposing the spores and a thin central columella. The elaters extend from the columella to the wall of the capsule, and when fully grown consist of a row of three or four cells.

This is but a brief summary of the principal facts concerning reproduction in the Hepaticæ, which could not have been extended without entering upon a long and specific account, such as the space proscribed for this volume would not permit.

The combinations of male and female organs are so complicated that they have originated the following six terms, which it is necessary, simply and briefly, to explain :—

Synoicous.—When the male and female sexual organs are intermixed in the same floral envelope.

Paroicous.—When with a hermaphrodite flower, or a pure female flower, a definite shoot on the same axis bears only antheridia.

Autoicous.—When the male and female sexual organs of the same plant are nevertheless found in a separate inflorescence.

Heteroicous.—When synoicous (or paroicous) and autoicous flowers are found on the same plant.

Dioicous.—When the male and female inflorescences are found on different individuals.

Polyoicous.—When the male and female sexual organs occur at one time on the same plant, and at another time on a different plant.

CLASSIFICATION.

It has already been intimated that, as at present understood, the *Muscineæ* include with the Bog-mosses and the true mosses, the Hepatics also, as one of the primary divisions of the Higher Cryptogamia. We have pointed out the distinctions between the several orders of Hepaticæ, and nothing remains but to indicate the subsidiary divisions, chiefly in so far as they relate to the *Jungermanniaceæ.* Sixty years ago, and for some time after, all the species were associated under the one genus *Jungermannia*, whether foliose or frondose; and, notwithstanding Gray's proposition of a number of new genera, in 1821, these were ignored in 1833, and it was not until some time after the publication of Gottsche and Lindenberg's Synopsis in 1844 that more than one genus of the *Jungermanniaceæ* was recognized in this country. The first departure was by Dr. Spruce in 1850, but it was not until 1865 that Mr. W. Carruthers called special

attention to Gray's genera, and Dr. Carrington in 1870 indicated those which had a good claim for adoption. Dumortier at this time, and previously, had been advocating and employing a classification, of which the colesule and its bracts was the chief basis, but this was only partially adopted, and was gradually superseded by a more natural arrangement, to which the writings of our own Dr. R. Spruce largely contributed, and which received perhaps its fullest expression in his "Hepaticæ Amazonicæ et Andinæ" in 1884. The arrangement herein adopted is based mainly upon the last-mentioned work, although for a small local flora it has not been considered advisable to adopt the subdivisions of each genera, as *Lejeunia*.

The primary division of the whole of the *Jungermanniaceæ* into two tribes, viz., the *Jubuleæ* and the *Jungermannieæ* seems to demand recognition. And in general terms it may be indicated that the *Jubuleæ* have a four-valved capsule, which dehisces for two-thirds of its length, with elaters of one spiral, whereas *Jungermannieæ* have a four-valved capsule, dehiscing to the base, and elaters of two spirals. Other distinctions are also indicated. Dr. Spruce says that "the *Jubuleæ* seem to me equivalent to nearly all the rest of the sub-order *Jungermanniaceæ*. The structure of the capsule, and especially of the elaters, is unique amongst Hepaticæ." The leaves of *Jubuleæ* are invariably alternate, and it is only in the female involucres of a limited number of species (chiefly of *Frullania*)

that opposite and connate leaves (or bracts) are to be seen. The spores are rather large, globose, sometimes angular by mutual pressure, almost always rough, tuberculate, or warted. Spruce's interpretation of the lower and entire portion of the capsule is, that this fleshy base is the dilated apex of the pedicel, analogous to the apophysis of some mosses.

The *Jungermanniea* are claimed to be distinct by the following characters " Female flowers polygynous. Pedicel not at all, or scarcely, dilated at the apex—never into a segment of a sphere, constituting a solid apophysis, nearly half the height of the cavity of the capsule, as in *Jubuleæ*. Capsule producing spores and elaters (the medial ones horizontal) on its entire inner surface, four-valved down to the base. Elaters bispiral—only by rare exception one-spiral, deciduous, either along with the bursting of the capsule, or a few of them persisting a little longer."

Leaves in some genera incubous or transverse, in the great majority they are succubous. Several genera have opposite leaves in every species; in other genera some species have alternate, others opposite leaves, while in others every known species has alternate leaves. But the leaves of *Jubuleæ* are invariably alternate. The leaves of *Jungermanniea* vary from broad and round to linear, and even setaceous, from quite entire to deeply laciniate. Complicate leaves are typical in a few genera; but the feature which prevails throughout *Jubuleæ* of a conduplicate-bilobed leaf with the smaller underlobe

either inflated or partially inrolled or cucullate—sometimes even bell-shaped or cylindrical—is almost unknown in *Jungermannieæ.* Several genera possess a character entirely unknown among *Jubuleæ*, viz., a perianth that is wide-mouthed throughout its existence, and therefore needs not to be ruptured for the emission of the capsule. The calyptra, as compared with the perianth, is of various lengths, being in some species scarcely at all shorter, but in others four times as short. The character of an inferior or half inferior calyptra, occurring in several genera of *Jungermannieæ*, is quite unknown in *Jubuleæ.* Elaters numerous—sometimes to be counted by thousands, produced on the whole inner surface of the capsule, usually slender and tortuous, narrower at each end (never truncate), and each includes two spiral fibres—rarely three or more—very rarely only one. When the capsule bursts they mostly fall out all together along with the spores. Spores very numerous and usually very minute, in only a few genera equalling these of the *Jubuleæ;* nearly always globose.

The *Jungermannieæ* are further sub-divided into eight sub-tribes, of which seven have the elaters normally bispiral. That is to say—the *Raduleæ*, *Porelleæ*, *Ptilidieæ*, *Trigonantheæ*, *Scapanioideæ*, *Epigoniantheæ* and *Fossombronieæ.* The eighth, *Metzgerieæ*, has the elaters monospiral, and at the same time the species are frondose. The relations of these several tribes to each other will be found under each, as hereafter follows:—

SYSTEMATIC ARRANGEMENT.

ORDER.—HEPATICÆ.

Fertile sacs opening regularly or irregularly, without any definite lid; borders of the fissure naked, not provided with any series of teeth (peristome), single or double.

Sub-order 1. JUNGERMANNIACEÆ.

Fruit solitary, capsular, four-valved, valves splitting, rarely torn. Elaters mixed with the spores. Vegetation either foliose or frondose.

TRIBE I. JUBULEÆ, *Dum.*

Ramification everywhere lateral. Leaves always alternate, incubous, complicately-bilobate, inferior lobule smaller, commonly inflated or saccate. Female flowers monogynous,

or 1-4-gynous. Capsule from the apex to two-thirds of its length four-valved, the lower third part solid. Elaters of one spiral, truncate, persistent.—*Spruce Hep. Amaz. p.* V. (1884).

GENUS I. FRULLANIA, *Raddi.*

Involucre indistinct, conforming to the leaves. Perianth three-cornered, constricted at the apex, doubly keeled at the back, mucronate at the apex; capsule four-valved, bearing the elaters in the middle, peduncle short; elaters unispiral, persistent.—*Jung. Etr. XVIII., p.* 20 (1820).

Branches within the axils, cauline leaves adjoining the base inwards and free. Leaves subtransverse, stout, for the most part entire, wall of the cells thickened, with trigones at the angles, rather large. Leaflets constantly present, subfloral innovations none. Female flowers 2-4-gynous, bracts multijugate. Cells of pedicel of four-strata, concentric (8 in. diameter of section, 32 in. circumference), sub-equal, alternate, joined together. Internal face of the capsule papillosely spongy.—*Spruce.*

The leaves of *Frullania* stand on a very small base, rarely half embracing the stem, and are almost exactly transverse. There is no decurrence of both lobe and lobule, which is an almost constant feature in *Lejeunia.* Underleaves, or stipules, are con-

stantly present, while in a few species of *Lejeunia* they are altogether absent. They are almost always broad, and at the apex bifid, very rarely entire. Radicles are produced, where needed, as in other hepatics. The female flowers are mostly acrogenous. The pistillidia vary in number from two to four. The calyptra is fleshy, as much as six or eight cells thick below the middle. The capsule in this genus, and the rest of *Jubuleæ*, is described as cloven into four valves, down only to a certain distance, which is about two-thirds, but entire at the broad, pale, fleshy base. Dr. Spruce considers it more correct to regard this entire portion as the dilated apex of the pedicel, analogous to the apophysis of some mosses. The apophysis in *Frullania* has the form of a shallow cup, only two or three cells thick, where it joins the true base of the valves, increasing to six or seven cells thick where it coalesces with the cylindrical stalk. The inner face of the capsule is covered with an opaque, reddish-brown cell-stratum, very uneven in its surface, reaching to the base of the true valves. Elaters and spores are developed in the capsule, only so far down as this discoloured, spongy surface extends. The structure of the capsule, and its contained organs, is essentially the same in other *Jubuleæ* as in *Frullania*. The foregoing is a summary of the remarks, under "Frullania," in Spruce's "Hepaticæ of the Amazons," p. 6.

Frullania dilatata, *L., Dum.*

Loosely and vaguely pinnate. Leaves or-

bicular, convex, entire; auricle hood-like, rather rounded, contiguous with the stem, involucral bifid, with the segments entire; stipules ovate, bifid, with the margins plane. Perianth ovate, tuberculate.

Jungermannia dilatata, Linn. Sp. 1600; Hook. Br. Jung., No. 5. *Jubula dilatata*, Dum. Syll. Jung., 36, t. 1, f. 5. *Lejeunia dilatata*, Corda in Sturm., 19, t. 12. *Frullania dilatata*, Dumort. Rev. Jung., p. 13; Gott. and Rabh. Exs. No. 54, 156; Carr. and Pears. Exs., No 47; Cooke Hep. f. 157.

Common on trunks of trees (Fr. Winter); growing in dense purplish-brown patches.

19.

Stems about ¾ inch long, creeping, and branched. Leaves in two opposite rows, distant below, and overlapping in the upper portion of the plant so as to conceal the stem, roundish, with a small lobe or auricle at the base, applied with its face to the leaf-stipules, notched at the apex. Calyx reversely heart-shaped, with a projecting angle on the underside; the whole surface covered with minute fleshy tubercles; mouth greatly contracted. Capsule globose yellowish brown.—(*Plate 1, fig. 1.*)

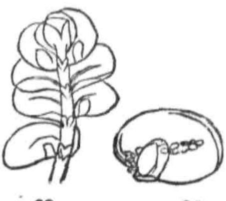
Fig. 19, with the lobule imperfect, but more accurate on Plate 1.

Frullania fragilifolia, *Tayl.*

Stems procumbent, subpinnate, branches rather remote; leaves spreading, suborbicular, entire, marked with a moniliform median line; auricles oblong (figs. 20, 21); stipules ovate, bifid; involucral leaves nearly equally lobed, sparsely dentate; perianth obovate, with one keel, even.

Frullania fragilifolia, Tayl. Trans. Bot. Soc. Edin. II., 43; Ann. Nat. Hist., 1843, p. 172; Gott. and Rab. Exs. No. 170, 200, 226; Spruce Hep. Pyr. in Trans. Bot. Ed. III., 215; Cooke Hep. figs. 160, 161.

On shady rocks and trees.



20. 21.

Scarcely exceeds ½ inch in length, of a dusky, reddish-brown colour, collected into thin patches, firmly attached to the rock's surface, or more rarely to the bark of trees Branches scarcely pinnately disposed. When the tip of the finger is pressed against the surface of the wet plant a multitude of leaves adhere. Cells of the leaves large. Calyx kidney-shaped, or nearly round. It may be distinguished from *Frullania tamarisci* by the wider cellulation of the leaves, want of lustre, fragility of the wet leaves, larger auricles in proportion to the leaves, the plane

margins of the stipules, the greater relative size of the perigonia to the plant, the large and obtuse teeth of the perichætial leaves, and, by the abnormal cellules being much larger. — *Taylor.* (*Plate 1, fig 2.*)

Frullania tamarisci, *L., Dum.*

Bipinnately branched, somewhat rigid. Leaves rounded-ovate, mucronate, entire, marked with a moniliform median line; auricle oblong, free from the stem; involucral leaves lanceolate-oblong, serrate; stipules subquadrate, emarginate; perianth ovate, one-keeled, even (fig. 23).

Jungermannia tamarisci, Linn. Sp. 1600; Hook. Br. Jung., No. 6. *Frullania tamarisci,* Dumort. Rev. Jung., p. 13.; Gott. and Rab. Exs. No. 80, 199, 455; Cooke Hep. f. 162, 163; Carr. and Pears. Exs. No. 48.

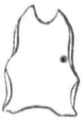
On the ground, and creeping over low bushes. (Fr. July, Aug.)

var. *α cornubica,* Carr. in Carr. and Pears. Exs. No. 49.

var. *β microphylla.* — *(Gott.)* Not larger than *F. fragilifolia,* stems more regularly pinnate; leaves from a broader base, more convex and polished; areolæ larger; involucral leaves acute, repand, nearly entire, the lobe lanceolate.

var. γ *atrovirens.*—(*Carr.*). Stems elongated; leaves elliptic-ovate, apiculate, inflexed, indigo-green, forming wide, shallow patches on rocks subject to inundation.

Spreading over large patches. Stems from 2 to 4 inches in length, creeping and branched. Leaves closely overlapping the whole upper surface, arranged in two opposite rows, roundish, with a small inflated lobule attached at the lower edge. Stipules obscurely notched at the apex (fig. 22). Calyx smooth, flat on the upper surface, keeled beneath, mouth attenuated to a long sharp point, opening with four teeth. Capsule globose, pale reddish-brown.—(*Plate 1, fig. 3.*)



22.

23.

Frullania germana, *Tayl.*

Stems procumbent, bipinnately branched; leaves imbricate, rounded-ovate, entire, conforming in their cellulose texture; auricle oblong-ovate, ventricose; stipules obovate, bifid at the apex; involucral entire; perianth oblong-ovate, one-keeled.

Frullania germana, Tayl. Trans. Bot. Soc. Edin. II., 45; Ann. Nat. Hist., 1843, 173; Gott. and Rab. Exs. No. 475; Carr. and Pears. Exs. No. 198. *Frullania tamarisci*, var. δ *germana*, Carr. Irish Crypt.

On bark of trees, and on rocks. The plant is 3 inches, and sometimes more, in length, and matted into patches sometimes a foot in breadth. It is never so black and shining as *Frullania tamarisci*. The fertile stems are longer, more branched, and more fastigiate; whilst those bearing perigonia are far narrower, and with shorter branches. The leaves are thin, and do not present the linear mark of enlarged opaque cells as in *Frullania tamarisci*. The stipules are wider than the stems, and the recurvation of their margin chiefly observable towards the summit. The margins of all the perichætial leaves are quite entire. The perigonium is a linear spike as in *Frullania dilatata*. Common and previously confounded with *Frullania tamarisci*, but readily distinguished when attention is paid to the entire perichætial leaves, to the linear perigonium, as well as to the lighter colour, and want of lustre in the leaves.—*Taylor*. *(Plate 1, fig. 4.)*

GENUS 2. JUBULA, *Dumort*.

Involucre bifoliate; perichætial leaves opposite, different in form from the leaves; perianth compressed, rather triangular, rostrate and acuminate; capsule four-valved,

membranaceous, valves bearing the elaters at the middle, inserted in a discoid stroma; elaters solitary, persistent.—*Dumort. Rev. Jung. p.* 12 (1835).

In this genus the perianth is axillary, the perichætial leaves distinct and opposite, not of the same form as the other leaves. Branches lateral, with a one-lobed, antical leaf, partly seated on the stem and part on the branch. Leaves of the stem, incurrent, tender, ciliate. Leaflets present. Female flowers 1-4-gynous. Subfloral innovations two, opposite, one rarely deficient. Bracts unijugate, adnate on both sides of the innovations. Pedicel of two opposed strata of cells, axial, four seriate, in section cruciate, sixteen smaller in the periphery. Capsule with the inner face nearly even or porose.

This genus is distinct from both *Frullania* and *Lejeunia*, and is in some respects intermediate between the two. It agrees with *Lejeunia* in the bracts of the female flower being adnate to subfloral ramuli (or innovations), also in the incurrent (not transverse) leaves, nor are there distinct trigones at the cellular angles, as in every *Frullania.* The apex of the pedicel is more dilated than in any *Lejeunia*, showing a quadrate, plane, or slightly concave surface, traversed by a great number of diagonal lines, crossing at right angles. *Jubula* agrees with *Frullania* in the axillary ramification, the saccate lobule, and the mono-tetragynous female flowers. It has one character not found in any species of either *Frullania* or *Lejeunia*, viz., the presence of an antical non-lobulate leaf at the insertion of every branch, seated partly on the stem, partly on the branch,

corresponding to the similarly placed leaf in *Bazzania*, *Blepharostoma*, &c.—*Spruce.*

Jubula Hutchinsiæ, *Hook.*, *Dumort.*

Subpinnately branched. Leaves ovate, acute, serrate, plane, auriculately spurred; involucral leaves deeply two-lobed; lobes linear-lanceolate, dentate; perianth obcordate, even, compressed.

Jungermannia Hutchinsiæ, Hook. Br. Jung. t. 1; Eng. Bot. t. 2480. *Frullania Hutchinsiæ*, Nees Eur. Leb. III., 240; Gott. and Rab. Exs. 208, 477; Carr. and Pears. Exs. No. 50; Cooke. Hep. fig. 158, 159. *Jubula Hutchinsiæ*, Dumort. Comm. p. 212; Spruce Hep. Amaz. p. 61.

24.

In damp places. (Fr. March, April.)

Forming large bluish-green patches. Stems creeping, 1 inch or 1½ inch in length, with long scattered branches. Leaves slightly overlapping, arranged in two opposite rows, egg-shaped, with a very minute lobule on the lower edge, margin toothed (fig. 25), stipules round at the base and cleft at the apex into two sharp teeth (fig. 24). Calyx reversely heart-shaped, flattened on the upper surface, with a longi-

25.

tudinal ridge on the lower. Capsule spherical, reddish brown.

"In various localities along the western coasts of England and Wales, Scotland and Ireland, it grows in some abundance and fruits freely. Elsewhere in Europe it has not yet been met with; but what are regarded as varieties of the same species exist in the warmer parts of North America, and in regions adjacent to the Equator all round the globe."—*Spruce.*

• var. β *compacta,* Carr. Stems gracile, closely imbricated; leaves smaller, more convex, in drier places.

GENUS 3. LEJEUNIA, *Lib.*

Involucre bifoliate; perianth sessile, ovate, not caudate, mouth contracted, three-toothed; peduncle articulate. Capsule capitate, quadrifid half-way, hyaline, membranaceous, segments bearing the elaters at their apices; elaters straight, terminal, persistent, double.—*Lib. Ann. gen. Sci.* V. *p.* 372 (1820).

In this connection the student may consult the observations of Dr. Spruce on *Lejeunia* in his "Hepaticæ Amazonicæ" (1884), p. 63.

Branches below the axils, contiguous to the outer base of the leaves. Leaf oblique or almost longitudinally inserted, for the most part tender, entire, toothed, or ciliately toothed. Leaflets in most species obvious, in a few none. Female

margin complicate, lobule convex; perianth obovate, mouth contracted, somewhat toothed.

Jungermannia microscopica, Mack. Fl. Hib. II., 59; Taylor Hook. Journ. IV., t. 20. *Lejeunia microscopica*, Taylor in Gott. Syn. Hep., p. 345; Cooke Hep. fig. 151; Carr. and Pears. Exs. No. 280. *Cololejeunia*, Spruce.

Amongst mosses, like a green stain.

Scarcely visible to the naked eye, pallid green, subpellucid. Stems two to three lines long, slender, flexuous, sparingly branched, here and there emitting short simple pellucid rootlets; leaves rather distant, flattened, acuminate, ovate-lanceolate, the elevated cells at the margin giving the appearance of serratures (fig. 26); perigonial leaves more obtuse at the apex, enclosing in the folds one or two rufescent ovate anthers, perichætial leaves binate, appressed to the base of cup; perianth tumid, obovate from a narrow base, ecostate, twice longer than the leaves; peduncle pellucid; capsule rounded-ovate, pale brown, quadrifid.

26.

Lejeunia calcarea, *Lib.*

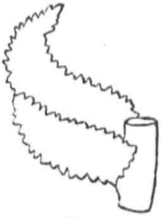
Thread-like, loosely and divaricately branched; leaves tranversely ovate, concave,

acuminate, echinately dentate, decurved, complicate at the base; involucral two-lobed, entire; perianth terete, apex pentagonal, with costate wings.

Jungermannia hamatifolia β echinata, Hook. Br. Jung. 51. *Jungermannia calcarea*, Lib. Crypt Exs. No. 111. *Jungermannia echinata*, Tayl. in Spruce Trans. Bot. Soc. Edin. II., 88. *Lejeunia calcarea*, Lib. Ann. VI., 373, t. 96, f. 1; Gott. and Rab. Exs. No. 46, 283, 323, 365; Spruce Trans. Bot. Soc. Edin. III., 212; Carr. and Pears. Exs. No. 278; Cooke Hep. f. 150. *Cololejeunia*, Spruce.

On Limestone rocks.

Very delicate and minute, so as scarcely to be visible to the naked eye, loosely and divaricately branched. Leaves ovate acuminate, echinulate and denticulate with the projecting cells (fig. 27), falcate, decurved, sinuately complicate at the base, the fold saccate, ovate, twice as short as the leaf. Involucral leaves bifid, the laciniæ entire. Perianth on a very short lateral branch, pear-shaped or clavate, acutely five-angled, the long margins echinulately muricate.—(*Plate 1, fig. 6.*)



27.

Lejeunia ulicina, *Taylor.*

Dioicous, very minute, stems thread-like,

half to one-third smaller than leaf, tumid at the keel, nearly flat, margin subrotund, unequally spinulose, exterior surface echinate, cells very minute. Folioles none. Female flowers on short branches, bracts similar to the leaves, but larger, lobule more finely dentate, perianth oval to pyriform, muricate, obtusely five-angled above.—(*Plate 1, fig. 7.*)

Lejeunia hamatifolia, *Hook., Dum.*

Thread-like, loosely branched; leaves transversal, concave, ovate, acuminate, entire, decurved, complicate at the base; stipules few, small, bifid; involucral leaves deeply two-lobed, serrate; perianth pentagonal, with costate wings.

Jungermannia hamatifolia, Hook. Br. Jung. t. 51; Eng. Bot. t. 2592. *Lejeunia hamatifolia*, Dum. Comm. 111; Gott. and Rab. Exs. 215, 476; Carr. and Pears. Exs. 75; Cooke Hep. f. 149.

On trunks.

Growing in small crowded green patches. Stems two to three lines to ½ inch long, very slender, thread-like, flexuous, procumbent, imbricate or creeping, each irregularly once or twice divided in a forked manner. Leaves rather close, seldom imbricate, bifarious, alternate, erect and

spreading, formed of two unequal lobes, of which the upper the largest, convex, ovate, acuminate at the extremity, where it is often curved, usually downwards (fig. 29), margins entire or serrate; lower lobe half the size of the upper, which it resembles in shape, involute, with the margin rarely slightly serrate. Colour pale green; perichætial leaves nearly twice the size of the cauline ones, two to each calyx, which they embrace at the base. Stipules small, ovate, acutely cleft half way down into two sharp equal segments, the margins entire. Calyx ovate or obovate, distinctly ribbed, with five prominent, and acute angles, nearly to the base, mouth contracted, generally elevated and tubular, cut into sharp fine teeth. Capsule spherical, white, membranous, cleft half way. Elaters bispiral.

29.

Lejeunia ovata, *Dicks., Tayl.*

Stems creeping, branched, subterete; leaves vertical, imbricate, incurrent, auriculate; larger limb plane, ovate, acute, lobule saccate; involucral leaves two-lobed; stipules small, distant, bifid; perianth obovate, apex acute, five-angled.

Jungermannia ovata, Dicks. Pl. Crypt. III., t. 8, f. 6. *Jungermannia serpyllifolia β. ovata*, Hook. Br. Jung. No. 42. *Lejeunia ovata*,

Taylor Gott. Syn. p. 376; Spruce Hep. Pyr. Trans. Bot. Soc. Edin. III., 212; Carr. and Pears. Exs. No. 52; Cooke Hep. fig. 154.

On damp rocks.

var. *pumila*, Carr. and Pears. Exs. No. 279.

Stems creeping, branched. Leaves vertical, imbricate, ovate, alternate, auriculate beneath, larger lobe plane ovate, (acute in Dickson's figure) lobule saccate and inflexed, often radiculose. Fruit terminal or lateral. Calyx obovate, acutely five-angled at the apex, mouth lacerated (*plate 1, fig. 8*). The figure 30 is a facsimile of Dickson's figure.

30.

Lejeunia serpyllifolia, *Dicks., Lib.*

Stems vaguely branched, lax, leaves incurrent, accumbent, auriculate, larger limb plane, rounded-oblong; stipules rounded, bifid, involucral deeply and unequally two-lobed, entire; perianth broadly ovate, pentagonal, mouth mucronate.

Jungermannia serpyllifolia, Dicks. Crypt. 4, p. 19; Hook. Br. Jung. t. 42; Eng. Bot. t. 2537. *Lejeunia serpyllifolia*, Lib. Ann. VI.,

374, t. 96, f. 2. ; Gott. and Rab. Exs. 47, 273, 435 ; Carr. and Pears. Exs. No. 135, 195 ; Cooke Hep. fig. 152, 153.

var. α *planiuscula*, Lindb.

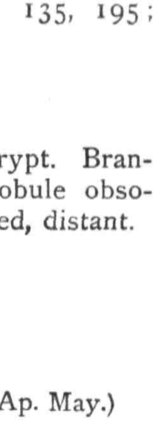
var. γ *heterophylla*, Carr. Irish Crypt. Branches attenuate, microphyllous ; lobule obsolete ; leaves plane, variously shaped, distant.

On wet shady rocks.

var. β *cavifolia*, Lindb.

On trunks and amongst moss. (Fr. Ap. May.)

Growing in rather large patches, stems ½ to ¾ inch, thread-like, flexuous, irregularly pinnate, branches mostly simple. Leaves rather closely imbricated, bifarious (fig. 31) somewhat two-lobed, upper lobe by far the largest, horizontal, ovate, slightly convex, the base beneath ventricose, where the upper lobe rises, which perhaps is only a dilated and involute portion of the margin. Colour pale yellow green. Perichætial leaves of different figure, from the rest, much larger, deeply divided into two oblong-ovate, obtuse, and slightly convex lobes, which closely embrace the calyx, the upper three times the size of the lower. Stipules roundish,



31.

plane, cleft one-third of their length into two sharp and equal segments, sinus rather acute (fig. 32). Calyx widely obovate, cylindrical at the base, gradually enlarging upwards, furnished with five longitudinal angles, mouth small, protruding into a short tube. Capsule spherical, white, transparent, split half down in four valves. Elaters bispiral.

32.

Lejeunia diversiloba, *Spruce.*

Shoots irregularly branched, branches divaricate, leaves incubous, vertical, large lobe oval, obtuse, entire, lobule variable in form, nearly equal, half the size, or obsolete, subquadrate, notched at the outer angle; stipules bifid, segments narrow, acute, dioicous.

Lejeunia cucullata δ *stricta*, N. L. and G. Syn. p. 390. *Lejeunia minutissima* β *major*, Carr. Irish Crypt., 1863. *Lejeunia diversiloba*, Spruce Journ. Bot., July, 1876. Carr. and Pears. Exs. No. 281; Journ. Bot., Feb., 1887, p. 38. Carr. Trans. Bot. Ed. XIII., p. 468, tab. 17, fig. 1.

Growing on prostrate mosses and hepatics.

Epiphytic on *Frullania*, &c.—Shoots filiform, rigid, irregularly branched; branches divaricate; leaves incubous, approximate, vertical; large lobe oval, or ovate, obtuse, slightly concave, pellucid,

entire ; lobules variable in form on the same branch, equal to the upper lobe, or half the size, or absent, subquadrate in form, inflated at the base, upper border inflexed, and notched at the outer angle, so as to form a rather blunt tooth. Stipules not broader than the stem, bifid for half their length, segments narrow, acute, incurved, sinus lunate, sometimes they are obsolete, or replaced by fascicles of very short rootlets. Inflorescence dioicous. Male spikes lateral, composed of few leaves, the lobes of which are equal. Female shoots lateral, sessile; involucral leaves larger, lobes ovate-oblong, and lobules lanceolate. In straggling patches of a pale yellowish green, sometimes nearly white.—*(Plate 1, fig. 10.)*

Lejeunia flava, *Sw.*

Stems vaguely branched or pinnate ; fertile branches innovate or dichotomous, for the most part ascending; leaves contiguous or subimbricate, oblique, oblong, or ovate-oblong ; base subdecurrent, complicate ; small lobule five to seven times shorter, triangular, saccate ; perianth green, pyriform ; calyptra thin, obovate ; capsule ovate-globose, on a rather long pedicel.

Jungermannia flava, Sw. Prod. Fl. Ind. Occ., 144. *Lejeunia flava,* Nees Hep. 373, Carr. and Pears. Exs. No. 283. *Eu-lejeunia flava,* Spruce Hep. Amaz. p. 268. *Lejeunia*

Moorei, Lindb. Hep. Hib., 1875. *Jungermannia serpyllifolia,* Eng. Bot. t. 2537. *Lejeunia serpyllifolia,* var. *thymifolia,* Carr. Irish Crypt.

Stem branched, creeping; leaves somewhat imbricate, oblong-oval, quite entire, apex subrotund or subangular; base sinuately complicate beneath; lobule convolute. Stipules twice as small as the leaves, ovate or cordate, acutely bifid to the middle, segments ovate-lanceolate, fruit lateral sessile at the base of the branches. Involucral leaves conforming, bilobate, lobule quadrate. Perianth obovate, exserted, acutely pentagonal.—G. L. and N. Syn.—*(Plate 1, fig. 12.)*

Lejeunia Holtii, *Spruce.*

Stems prostrate, creeping; leaves distichous, spreading, ovate-oblong, obtuse, complicate at the base; lobules small, inflated, gradually merging in the leaf at the apex, or shortly acute; stipules orbicular, bifid; flowers monoicous, on very short branchlets. Perianth pear-shaped, five-keeled.

Lejeunia Holtii, Spruce Journ. Bot., Feb., 1887, p. 33, 72; Carr. and Pears. Exs. No. 282.

On shady rocks.

Fragile, yellowish then reddish. Stems 1 to 1½ inch long, prostrate, creeping amongst moss, rarely forming a stratum, with a few pinnate branches. Leaves broadly spreading, in two rows, flattened or decurved, distinct or contiguous, rarely somewhat imbricated, suboblique, ovate-oblong or ovate, obtuse, rarely rounded, complicate at the base, lobules small—more than five times shorter than the leaves, subovoid, inflated, apex gradually running into the leaf, or shortly acute and incurved, elongated on the stems, not rarely obsolete; cells hexagonal. Stipules three times shorter than the leaves, distant, orbicular, obtusely bifid to the middle, segments acute, or rather obtuse, monoicous on short branches. Bracts twice as short as the leaves, spreading, bilobed half way, lobes complicate, lanceolate. Perianth emersed, pear-shaped, depressed at the apex, with a short mucronate beak, five-keeled. Calyptra half shorter, obovate, constricted at the base. Capsule globose.

Differs from every other European *Lejeunia* in the female flowers being borne on exceedingly short branchlets, which normally put forth no subfloral innovation. Another important and unique character is afforded by the large pear-shaped perianths being so very strongly and sharply keeled that they seem broadly five-winged.—(*Plate 1, fig. 9.*)

Lejeunia patens, *Lindb.*

Pallid, pellucid, shining when dry; stems branched and intricate; leaves rounded-ovate;

antical lobe very convex, abruptly erect from a basilar sac; stipules spreading, with a broad obtuse sinus to the middle, roundish, convex; perianth five-plicate above.

Lejeunia patens, Lindb. Irish Hepat., 1875, p. 483; Carr. and Pears. Exs. No. 284. *Lejeunia serpyllifolia*, var. *ovata*, Nees. Hep. p. 294.

Autoicous, shorter, and twice narrower, pallid, pellucid, shining when dry, very often more branched and intricate, convex or subterete; leaves more or less dense; antical lobe very convex, incubous, when dry straight, abruptly erect from a basilar sac, very decurrent, oblique, broadly ovate-elliptic or oval, very obtuse, cellules rather prominent, crenulate, basilar sac two to four times less. Stipules spreading, two to four times less than the postical lobe, very convex, roundish, split to the middle, sinus more or less broad and obtuse, segments rather obtuse, margins everywhere crenulate with the prominent cells. Perianth on lateral branches, a little emergent, clavate pear-shaped, terete below, above five-plicate one-fourth way down, crests higher, complanate, the edge crenulate.—*(Plate 1, fig. 11.)*

Lejeunia Mackaii, *Hook., Dum.*

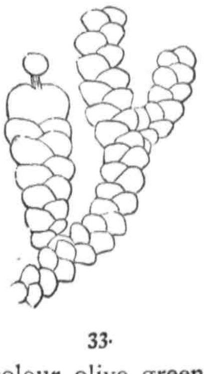
Stems creeping, vaguely branched; curved; leaves distichous, two-lobed; auricles involute,

ventricose ; stipules obcordate, plane ; perianth compressed.

Jungermannia Mackaii, Hook. Br. Jung. t. 53 ; Eng. Bot. t. 2573. *Phragmicoma Mackaii*, Dumort. Comm. p. 112 ; Gott. and Rabh. Exs. 81, 164, 206 ; Cooke Hep. fig. 147, 148 ; Carr. and Pears. Exs. No. 133, 134. *Homalo-Lejeunia Mackaii*, Spr. Hep. Amaz. p. 134.

On rocks, sometimes on trees. (Fr. Winter.)

Growing in dense blackish green patches, from 1 to 2 inches to many feet in diameter. Stems creeping over each other in successive layers. Each ½ to 1½ inch long, slender, thread-like, flexuous, once or twice, branched irregularly; branches variable in length, leaves rather closely imbricated in two rows, over the whole upper surface of the stem (fig. 33), horizontal, divided into two unequal lobes, roundish, slightly convex, the lesser one scarcely one-tenth of the size, involute and ventricose. When dry the whole surface seems to be punctate, colour olive green, approaching black. Perichætial leaves resembling the cauline, but larger, with a lobule half the size of the lobe, adpressed to the calyx. Stipules large,



33.

roundish, entire or obtusely notched. Calyx obcordate, depressed, beside the two angles from the sides a third projects from the under surface (fig. 34), mouth at first a central tubular apiculus, at length divided into four acute teeth. Capsule spherical, delicate, whitish, cleft to the thickened apex of the peduncle. Elaters bispiral, persistent.—*(Plate 1, fig. 13.)*

34.

Lejeunia calyptrifolia, *Hook., Dum.*

Leaves bladder-like, calyptriform, ovate, cuspidate; basilar auricle circumvolute; perichætial quadrate, obtusely emarginate; perianth five-keeled, depressed at the apex.

Lejeunia calyptrifolia, Hook. Br. Jung. t. 43; Eng. Bot. t. 2, 538; Cooke Hep. fig. 156; Carr. and Pears. Exs. 197. *Coluro-Lejeunia calyptrifolia*, Spruce Hep. Amaz. p. 304.

On furze and rocks.

Grows in little pale green tufts, scarcely ½ inch broad. Stems procumbent, one to two lines long, creeping, thread-like, once or twice divided, with spreading branches, of a pale green. Leaves rather close, bifarious, horizontal, spreading or erect, largest at the base, gradually lessening to the apex, unequally two-lobed, having the superior the

largest, of the same shape as the calyptra in mosses, oviform, its base narrowed, furnished with a narrow opening about half the length of the leaf, the apex lengthened out, incurved and acute; lesser lobe subquadrate, with obtuse angles, adpressed to the larger one, half embracing it, and concealing the opening. Colour pale yellow green. Perichætial leaves from two to four, erect, adpressed to the calyx and about one-fourth the length, nearly quadrate, sides incurved, apex obtusely and widely emarginate. Stipules small, oblong, plane, adpressed or a little spreading, cleft one-third by an acute sinus into two nearly equal acute segments. Calyx oblong, attenuated at the base, widening upwards, with five projecting angles, or teeth, apex depressed, mouth contracted and jagged. Capsule membranous, white, four cleft half way down. Elaters bispiral (fig. 35).

35.

Tribe II. JUNGERMANNIEÆ.

Female flowers with few or many pistillidia (5 to 80). Capsule globose, oblong, or

cylindrical, dehiscing to the base in four valves. Elaters almost always with two spirals, rarely with one spiral, or three to four, deciduous.—*Spruce Hep. Amaz., p. vi.*

Distinct by the polygynous female flowers, pedicel not at all or scarcely dilated at the apex, never into a solid apophysis as in *Jubuleæ*. Capsule producing spores and elaters on its entire inner surface, four-valved to the base. Elaters bispiral—rarely monospiral, deciduous.

SECTION A.—*Elaters normally bispiral.*

Sub-Tribe I. RADULEÆ.

Branches all lateral, infra-axillary ; leaves incubous, leaflets none ; perianth from the front almost always compressed, mouth broad, truncate.—*Spr.*

GENUS 4. **RADULA**, *Dumort.*

Involucre indistinct, conforming to the leaves ; perichætial leaves bilobed, conduplicate; perianth flattened at the back, mouth truncate, entire, not laterally split; capsule four-valved, semi-pellucid, cellular, funnel-

shaped, naked ; elaters two-spired, deciduous. —*Dumort. Rev. Jung.*, 14.

Radula is apparently separated by a wide interval from every other genus. It has one unique character, *viz.*, the attachment of the radicles to the under lobe of the side leaves, and not to the under leaves, or the underside of the stem, as in all other hepatics. In the branches springing from the outer base of the leaves it agrees with *Lejeunea*, and with no other. In its most essential features it differs altogether from *Lejeunea; e.g.*, in the polygynous female flowers, the macrostomous perianth, the stout pedicel, composed of six to eight concentric layers of alternate cells, and above all in the very numerous long slender two-spired deciduous elaters.—*Spruce.*

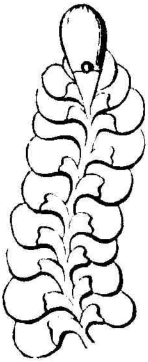
Radula complanata, *L.*, *Dum.*

Stem creeping, flattened, branched, somewhat pinnate; leaves auriculate behind, plane, rounded, entire; auricle four times shorter, adpressed, angle rounded. Perianth flattened, mouth entire.

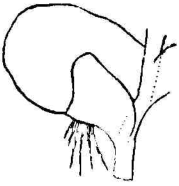
Jungermannia complanata, Linn. Sp. 1599; Hook. Br. Jung. t. 81; Eng. Bot. t. 2499. *Radula complanata*, Dumort. p. 112; Gott. and Rab. Exs. 17, 361; Carr. and Pears. Exs. No. 129, 130; Cooke Hep. f. 137, 138.

On trunks. (Fr. April, May.)

Monoicous.



36.



37.

Densely imbricated, forming wide compressed tufts. Stems 1½ to 2 inches long, creeping, variously branched, branches again pinnate, and innovant, with a few pellucid radicles proceeding from the leaves. Leaves closely imbricated, in a bifarious manner (fig. 36), concealing the stem, unequally two-lobed; superior lobe much the largest, orbicular, nearly flat; inferior lobe ovate, adpressed, flat, often radiculose (fig. 37). Colour, pale yellow green. Perichætial leaves differing little from the cauline ones, except in the two lobes being more equal. Stipules none. Calyx oblong, from a cylindrical base, becoming wider, compressed, flat at the apex and truncate, nearly entire, or only cleft on one side. Capsule ovate, pale brown, furrowed. Elaters bispiral.

Radula voluta, *Tayl.*

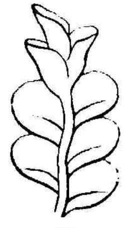
Stem procumbent, pinnately branched; leaves auriculate behind, densely imbricate, orbicular, entire, complicate at the base; auricle large, rounded-cordate, excised at the base, and rather embracing the stem.

Radula voluta, Taylor in Syn. Hep. 255;

Cooke Hep. f. 139; Carr. in Trans. Bot. Soc. Ed. VII., 455; Carr. and Pears. Exs. No. 44. *Radula xalapensis*, Lind. Hep. Hib., p. 491.

On boulders.

Dioicous. Stem procumbent, pinnately branched, rather rigid, the upper branches subfasciculate. Leaves rather imbricate, roundish, obtuse, entire, complicate at the base and subdecurrent, lobule large, rounded-cordate, mostly obtuse, transversely protracted above the stem, excised and rather embracing at the base, plane or rather undulate (fig. 38).



38.

The male spikes consist of three to four pairs of perigonial leaves, each enclosing two anthers, they are at first seated near the apex of small lateral shoots, but by the growth of the terminal bud, appear at length basal.—*Carr.*

Radula aquilegia, *Tayl.*

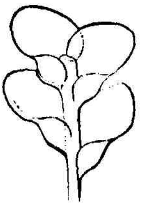
Stems cæspitose, subpinnate, depressed; leaves rather erect, convex, entire, rounded obovate, margin recurved; perichætial leaves deflexed; perianth elongated, obconic.

Jungermannia aquilegia, Tayl. Trans. Bot. Soc. Edin. II., 117. *Radula aquilegia*, Tayl. in Syn. Hep. p. 260; Gott. and Rabh. Exs. No. 207; Cooke Hep. f. 139, 140; Carr. and Pears. Exs. No. 43.

On rocks, over which water constantly trickles.

Dioicous. Patches wide, shallow, brownish-olive. Stems 1 to 4 inches long, irregularly pinnate (fig. 39). The branches nearly at right angles to the stem. Leaves from a narrow base, flatly cup-shaped ; their lower lobe swelling out at its involution, while their angulate tops lie closely adpressed to the inside of the upper lobe (fig. 40).

39.


40.

It differs from *R. complanata* in the smaller and more convex leaves, their olive-brown colour, their lesser lobe not sharply reflected upon the upper, but having a turned base, by the deflected perichætial leaves, by the perigonia occurring usually at the termination of the shoot, and not on proper short lateral branches, and by the angulate portion of the lower lobes of the leaves being shorter. This species prefers very wet surfaces of mural rocks, while *R. complanata* is partial to trees.—*Taylor.*

Radula Lindbergii, *Gott.*

Dioicous, stems prostrate, subpinnately branched, branches ascending, leaves imbricate, ascending, nearly plane, quite entire, superior lobe obovate, rounded, inferior lobe four times smaller, depressed quadrate, angle acute, involucral obovate-elongate ; perianth obovate, compressed, truncate ; male inflores-

cence on proper plant, terminal and lateral, forming long narrow spikes.

Radula Lindenbergii, Hartt. Skand. Flora, 1871. *Radula Lindbergii,* Gott. in Revue Bry., 1882, p. 82. *Radula Lindbergiana,* Jack. Flora, 1881, p. 181. *Radula commutata,* Gottsche Jack. Flora, 181, t. 8, f. 5. *Radula germana,* Jack. Flora, 1881, Vol. VIII., fig. 6.

On rocks and amongst moss.—(*Plate 1, fig. 16.*)

Spruce (Journ. Bot., 1887, p. 210) regards *Radula Lindbergii,* as including also *R. germana,* Jack., and *R. commutata* Gottsche.

The form, called *R. germana* resembles large forms of *Lejeunia serpyllifolia,* growing in patches procumbently, with shoots imbricating, or growing erect when intertwined with mosses, of a pale yellowish green, or darker, with the old parts sordid brown. Stems ¾ to 1 inch long, frontally compressed, those of female plant subpinnate, furcate or dichotomous, barren male stems often almost simple. Rootlets few. Leaves alternate, ascending, the upper ones imbricating each other, those of the lower portion approximate. On slender stems the leaves are more distant, roundish ovate, or obovate, convex, hiding the stem, entire, superior lobes often irregularly erose, lobule usually one-third less. rhomboid, subquadrate, ovate, at the free corner acute or obtuse, base tumid, upper portion plane and appressed. Involucral leaves accrescent, oblong, with narrower lobes and lobules, enclosing seven to ten sterile archegonia, perigonial leaves

closely imbricating, smaller, ovate, ventricose, with lobule ovate, almost equal to superior lobe, forming a deep pouch, cells small, hexagonal; perianth compressed, obconical, with a gradually tapering base, mouth entire. Capsule oblong-oval. Elaters bispiral, curved, lax.

Radula Carringtonii, *Jack.*

Dioicous. Stems cæspitose, prostrate, subpinnately branched; leaves imbricate, spreading, entire, superior lobe rounded, subreniform, inferior four times smaller, quadrate, adpressed.

Radula aquilegia var. major, Carr. Trans. Ed. VII., p. 455. *Radula Carringtonii*, Jack. Journ. Bot. XX., 1882; Revue Bryol., 1882, p. 16.

On shady rocks and trees.—(*Plate 1, fig. 15.*)

This species grows in close patches of an olive green, or brown colour. The stems are from 4 to 5 centimètres long, irregularly pinnate, with somewhat ascending branches. The leaves imbricate one another, and are almost flat, margin entire, the superior lobe stands off obliquely from the stem, is rotundate, almost reniform. The lobule reaches hardly to half the length and breadth of the superior lobe, with which it forms a sharp angle, and upon which it lies flat. The same is quadrate, or more or less trapeziform. The female involucral leaves are oblong-oval, with oval rotundate lobules two-thirds as large. Archegonia seven to eight.

From *R. complanata*, which it resembles in size and form; it is at once distinguished by the dull, pale

glaucous leaves, and the monoicous inflorescence of that species. The shoots are irregularly pinnate or bipinnate, the branches alternate, and generally short.

Radula Holtii, *Spr.*

Stem creeping, sparingly branched. Leaves rounded-oblong, complicate, saccate from a decurrent base, lobule three times smaller, trapeziform, only inflated at the keel. Perianth emersed, trumpet-shaped, terete, a little compressed at the mouth. Dioicous.

Radula Holtii, Spruce Journ. Bot., July, 1887, p. 209.

Within the spray of a waterfall.

Dioicous; reddish or olive green; stem creeping scarcely ½ inch, sparingly branched, partly pinnate, partly dichotomous. Leaves contiguous or separate, complicate saccate from a decurrent base, at an angle of 45°, abruptly patent, oblique, rounded-oblong, plane or subconcave, repand, long incurrent, basal angle not veiling the stem; lobule three times shorter, trapeziform, obtuse or slightly acute, nearly plane, only inflated at the keel; cells small, equilateral, not thickened at the angles. Flowers terminal, on a unilateral or two opposite innovations. Bracts often unijugate, erect, closely imbricate, bilobed to the middle, larger lobe broadly obovate, lobule half as long, roundish. Perianth emersed, thin, somewhat incurved, trumpet shaped or club shaped, everywhere almost terete, only at the apex a little

compressed, mouth truncate, obsoletely four-lobed. Andræcium terminal on the branches, bracts two or three joined, except for the lobule somewhat larger, scarcely differing from the leaves.

Sub-tribe II. PORELLEÆ.

Branches all lateral, intra-axillary; leaves incubous, lobules of equal size. Perianth with the mouth lacinulate, at first constricted, at length gaping and bilabiate. Capsule four-valved, the valves often incompletely disconnected at the base, irregularly split.

GENUS 5. **PORELLA**, *Dill.*

Branches lateral, intra-axillary, pinnate; leaves incubous, deeply lobate. Perianth at first constricted, then gaping and two-lipped. Capsule globose, rarely valvate to the very base. *Dill. Hist. Musc.* (1741). Madotheca, *Dum. Comm.* (1823). *Vide* Spruce, Hep. Amaz. p. 326.

Porella differs from all *Radulæ* in the regularly pinnate and feather-like stems; the axillary branches (not infra-axillary, as in *Radula*, but intra-axillary); the universal presence of underleaves, the basal angles of which, like the external base of

the lobules, are often decurrent on the stem, in the shape of a laciniate and crispate wing; the side leaves (especially on the branches) often subopposite; the bracts of the male spikes exactly opposite, and connate with the intervening underleaf, the toothed or ciliated female bracts; the much shorter and usually less compressed perianth, at first constricted at the laciniate mouth, and only becoming two-lipped or campanulate by the extrusion of the fruit, the globose capsule, the valves rarely separate down to the very base; the smaller, shorter elaters, and the comparatively much larger spores.—*Spruce.*

Porella lævigata, *Schr.*

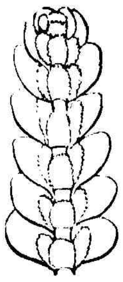
Stem procumbent, bipinnately branched, leaves broadly ovate, dentate, acute; auricles and stipules oblong-quadrate, spinulosely-toothed. Perianth dentate.

Jungermannia lævigata, Schrad. Samm. No. 104; Hook. Br. Jung. No. 35. *Madotheca lævigata,* Dum. Comm., p. 111; Gott. and Rab. Exs. 53, 259, 373; Cooke Hep. f. 141. *Porella lævigata,* Carr. and Pears. Exs. No. 45, 274, 275.

On the ground and on rocks.

Growing in loose patches. Stems procumbent, flexuose, 2 to 3 or 4 inches long, with numerous scattered lateral branches. Leaves at the base and extremity smallest everywhere in two opposite

rows, closely imbricated and placed alternately, divided into two unequal lobes (fig. 41), the upper much the largest, convex, smooth, roundish, ovate, margin sometimes entire, sometimes dentate with unequal spinulose teeth, at irregular distances. The inferior lobe scarcely one-third so large, obliquely adpressed, oblong or ligulate, margins dentate, teeth occasionally recurved. Stipules one to each pair of leaves, oblong-quadrate, resembling the smaller lobe, spinulose dentate at the margin.—*(Plate 2, fig. 17.)*



41.

Porella platyphylla, *Linn.*

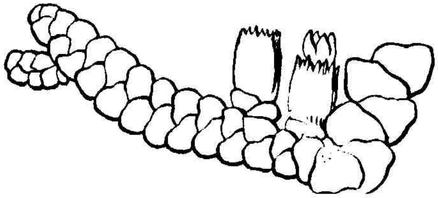
Stem procumbent, bipinnately branched, leaves rounded-ovate, and, as well as the auricles and strap-like stipules, quite entire. Involucral leaves toothed or entire.

Jungermannia platyphylla, Linn. Sp. 1600; Eng. Bot. t. 798; Hook. Br. Jung. t. 40. *Madotheca platyphylla*, Dumort. Comm., p. 111; Gott. and Rabh. Exs. No. 51, 157, 158, 363, 364; Cooke Hep. f. 143, 144, 145. *Lejeunia platyphylla*, Corda. in Sturm. Fl. XXII., t. 26. *Porella platyphylla*, Carr. and Pears. Exs. No. 71.

On trunks, &c.

var. β *major*, vaguely bipinnately branched,

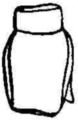
leaves large, smooth, greenish yellow.—*Hook. Br. Jung. t.* 40, *f.* 4.



42.

Old walls, rocks, and trunks. (Fr. March, April.)

Grows in considerable patches. Stems 1 to 2 or 3 inches long, flexuose, often pinnate, with straggling branches, which are again shortly branched. Leaves closely imbricate in two rows, so as to conceal the upper part of the stem (fig. 42), unequally two-lobed, the upper lobe the largest, alternate, ovate, approaching round, slightly concave, margins incurved, entire, or here and there slightly toothed, lower lobe strap-shaped, diagonally pressed to the surface of the upper, plane, margins recurved and entire. Colour, deep or blackish green, opaque. Perichætial leaves like the cauline, but smaller, and the lobule proportionately larger, two to each calyx, stipules adpressed, oblong ovate,



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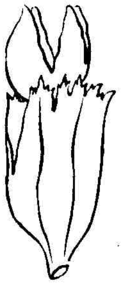

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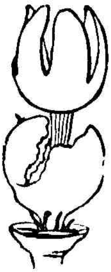


45.

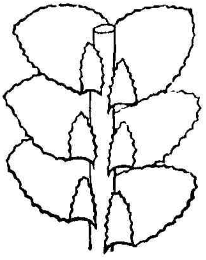
or ligulate, margin recurved and entire (fig. 43). Calyx ovate, compressed and flat, then erect, cylindrical, mouth truncate, serrate, deep notch on one side, half its length (figs. 44, 45). Capsule pale yellow brown. Elaters bispiral.—(*Plate 2, fig. 18.*)

Porella rivularis, *N.*

Branches simply pinnate, leaves entire, ovate, obtuse, decurved, shortly auriculate, auricule sometimes discrete, stipules semilunate, decurrent. Perianth two-lipped, mouth crenate.

Madotheca rivularis, Nees Eur. Leb. 3, p. 196; Gott. and Rab. Exs. No. 371; Cooke Hep. f. 142. *Porella rivularis*, Carr. and Pears. Exs. 131.

On stones in streams.



46.

Tufts wide, loose, dark green, the younger shoots of a lively green. Stem, 1 to 2 inches long, irregularly branched, scarcely pinnate, branches short, patent. Leaves oblong-rounded, sometimes a little narrower at the top, quite entire (fig. 46), their structure densely and minutely cellular. The lower lobe is more minute, in proportion to the upper, than in any of its congeners, the stipules are scarcely wider than the stem.—*Taylor.* (*Plate 2, fig. 19.*)

Porella thuja, *Dicks.*

Cæspitose, stem ascending, subpinnately branched, above convex, smooth, leaves closely imbricated, lower lobe spreading, elongated, recurved, entire; interior ovate, rather obtuse, margin reflexed; stipules oblong, acute, entire, margin reflexed, recurved at the apex; perichætial lateral, emergent, leaves larger, ciliately serrate.

Jungermannia thuja, Dicks. Crypt. 4, p. 19; Taylor Trans. Bot. Soc. Edin. II., 116. *Madotheca thuja,* Dumort. Comm., p. 111. *Porella thuja,* Carr. and Pears. Exs. No. 46. *Jungermannia platyphylla* v. *thuja,* Hook. Jung. t. 40, fig.

On stones by lake sides.

Tufts wide, olive green, the older parts purplish brown, shining, the shoots acuminated. In plants with perichætia the branches are very short. It may be known from *P. platyphylla* by its greater size, its shining surface, its acuminate shoots, its denser structure, its perichætia prominent beyond the stem leaves, its perichætial leaves larger, wider, more divergent, and always ciliately-serrate, its divisions less regularly pinnate, the closer imbrication of the leaves, and the more patent position of their inferior lobes.—*Taylor.* (*Plate 2, fig. 20.*)

Porella pinnata, *Lind.*

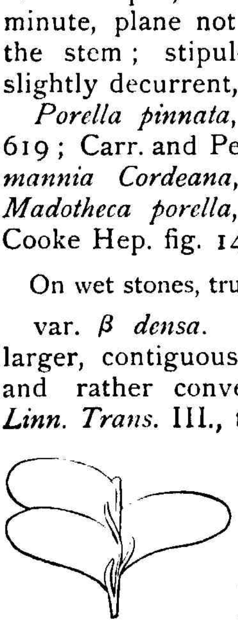
Stems irregularly pinnate, or subdichoto-

mously branched. Leaves slightly adpressed, ovate-oblong, plane or indistinctly decurved at the apex, margin quite entire, lobule minute, plane not decurved, spreading from the stem; stipules adpressed to the stem, slightly decurrent, obtuse rotundate.

Porella pinnata, Lindb. Moore Ir. Crypt. 619; Carr. and Pears. Exs. No. 132. *Jungermannia Cordeana*, Hub. Hep. Germ. 291. *Madotheca porella*, Nees Eur. Leb. 3, 201; Cooke Hep. fig. 146.

On wet stones, trunks, &c.

var. *β densa*. Branches shorter; leaves larger, contiguous and plane, or imbricated, and rather convex, lobule obtuse.—*Dicks. Linn. Trans.* III., t. 20, f. 1.



47.

Stems 2 to 4 inches long, pinnately branched, the forked branches spreading, leaves distantly placed, the lower lobe smallest (fig. 47), pressed to the stem and flat. Stipules rather square. Mouth of the perianth with small, round notches.—(*Plate 2, fig. 21.*)

Sub-tribe III. PTILIDEÆ.

Female flowers either always on the stem or on a lateral branch (never postical), longer or shorter, terminal. Leaves incubous, or

succubous, leaflets (always present) nearly of equal size, conforming, bi- or multi-fid.

There can be no doubt of the close relationship of the plants combined in this group, their most obvious character being the equably tristichous cloven leaves, whereof the postical are nearly, or quite as large as the lateral, and are never absent in any species. The polyphyllous female involucres always borne either on the apex of the stem or of a side branch—never on a postical branch, although such branches exist in, at least, two genera—afford another good and very constant character.—*Spruce.*

GENUS 6. **PTILIDIUM**, *Nees.*

Involucre two to three leaved, leaves appressed, two or three lobed, divided, elongated ciliate; perianth twice as long as the perichætium, clavate, inflated, rather plicate at the apex; mouth contracted, toothed; capsule four-valved, coriaceous, naked; elaters geminate, naked, deciduous. *Ptilidium*, Nees Eur. Leb. (1833) I., p. 95. *Blepharozia*, Dumort. Syll. p., 46.

Stipulate, leaves incurrent, two-lobed, conduplicate.

Ptilidium ciliare, *Linn.*, *Dum.*

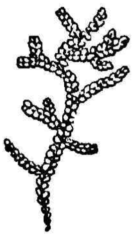
Stem procumbent, pinnate, branches alter-

nate, distichous; leaves bifarious, conduplicate, two-lobed, ciliate, auricle bifid; stipules lobate; perianth lateral, obovate, mouth plicate, contracted, torn and toothed.

Lichenastrum scorpioides, Dill. Hist. Musc. p. 481, t. 69, f. 3. *Jungermannia ciliaris*, Linn. Sp. 1601; Eng. Bot. t. 2241; Hook. Br. Jung. No. 65. *Ptilidium ciliare*, Nees Eur. Leb. p. 117; Gott. and Rab. Exs. 9, 197; Carr. and Pears. Exs. 127A, 127B; Cooke Hep. fig. 132, 135. *Blepharozia ciliaris*, Dum. Rev. Jung. p. 16.

On heaths, &c.

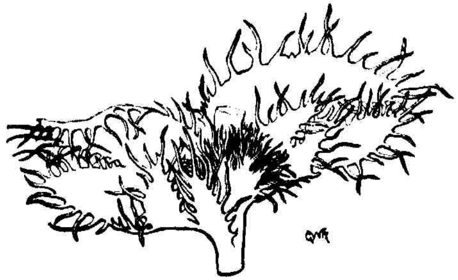
Growing in densely matted purplish-brown patches. Stems 1 to 2 or 3 inches long, procumbent, or rarely suberect, flexuous, thread-like, with rather distant alternate pinnæ, (fig. 48), which are spreading and usually simple, sometimes branched. Leaves more or less densely crowded, bifarious, imbricating over the upper surface of the stem (fig. 49), not sensibly diminishing in size. They are roundish or subquadrate, distinctly divided into two unequal lobes, upper one the largest, convex, and cleft for about half its length into two rather acute seg-



48.

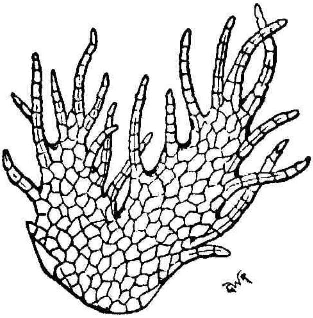
49.

ments ; the lesser lobe nearly plane, and not more than one-third the size of the other, in like manner divided into two lanceolate acute segments, the whole elegantly bordered with long capillary,



50.

flexuose cilia (fig. 50), rarely forked, and jointed throughout ; brownish-green or purplish-brown. Stipules quadrate, broader than the stem, adpressed, unequally lobed at the end, along the whole margin fringed with long cilia, which are narrower than on the leaves (fig. 51). Perichætial leaves, two or three at the base of each calyx, closely adpressed, widely ovate, cut into two or three unequal segments, and ciliate along the margin. Calyx thin and delicate, obovate, mouth small, much contracted, unequally toothed, capsule ovate, dark brown.



51.

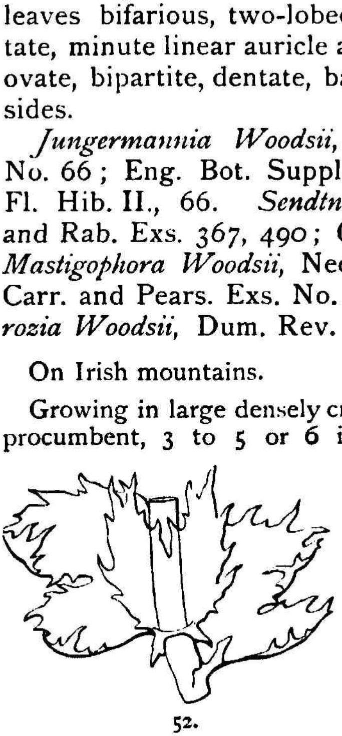
Ptilidium Woodsii, *Dum.*

Stem procumbent, two to three pinnate, leaves bifarious, two-lobed, spinulosely dentate, minute linear auricle at the base; stipules ovate, bipartite, dentate, base spurred on both sides.

Jungermannia Woodsii, Hook. Br. Jung. No. 66; Eng. Bot. Suppl. t. 2668; Mackay Fl. Hib. II., 66. *Sendtnera Woodsii,* Gott. and Rab. Exs. 367, 490; Cooke Hep. f. 131. *Mastigophora Woodsii,* Nees Eur. Leb. 3, 93. Carr. and Pears. Exs. No. 128, 271. *Blepharozia Woodsii,* Dum. Rev. Jung. p. 16.

On Irish mountains.

Growing in large densely crowded patches, stems procumbent, 3 to 5 or 6 inches long, flexuous, thread-like, once or twice dichotomous, beset throughout with rather distant spreading pinnæ, which are either simple or again pinnate, dirty brown. Leaves closely placed, in the extreme ramuli, largest at the apex, in the rest gradually smaller, everywhere imbricate, and bifarious; round or subquadrate, of two unequal lobes, the upper the largest, convex, divided for half its length by an acute sinus into two ovate



52.

segments, beset at the margin with variously sized, rather large, spinulose teeth; inferior lobe very minute and oblong, margin nearly entire. Colour purplish-brown, stipules very large, broader than the stem, widely ovate, cleft into two spiny-toothed segments, with a reflexed spur at the base (fig. 52).

GENUS 7. HERBERTA, *Gray.*

Involucre many-leaved, leaves connate at the base, deeply two-lobed; perianth none, calyptra included; capsule four-valved, coriaceous, naked; elaters double, naked, deciduous. *Gray Arr. I.*, 705. Schisma, *Dumort. Hep. Eur.*, t. 4, f. 38. See Spruce, Hep. Amaz. p. 340.

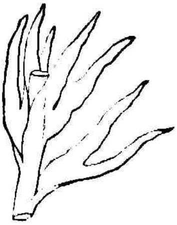
Herberta adunca, *Dicks.*

Stem erect, flexuous; leaves quadrifarious, falcate, secund, elongated, bipartite; laciniæ awl-shaped, long, acuminate, straight, entire at the base.

Jungermannia adunca, Dicks. Crypt. III., p. 12, t. 8. *Jungermannia juniperina* v. *adunca*, Hook. Br. Jung. t. 4. *Schisma aduncam*, Dumort. Comm. p. 116. *Sendtnera adunca*, Gott. and Rab. Exs. 210; Carr. Trans. Bot. Soc. Edin. VII., 454; Cooke Hep. f. 130. *Herberta adunca*, Carr. and Pears. Exs. No 42.

Amongst rocks, in dense crowded tufts.

Tufts several inches broad. Stems reddish brown, 2 or 3 to 5 inches long, flexuous, simple, or rarely slightly branched, Leaves in four rows, thickly imbricated, or more scattered, falcate, lanceolate, divided nearly three parts down by an acute sinus into two equal, entire, acuminate segments (fig. 53), pale yellow brown, rigid. Involucral leaves numerous, crowded, united at their base, acuminate segments alone free, calyx ovate, plicate. Calyptra ovate, white. Capsule dark brown, quadrivalvate. Elaters bispiral.



53.

var. *straminea Dum.* Leaves ovate, or ovate-lanceolate, segments erect, lanceolate, colour darker brown, or almost black.—*Schisma straminea,* Dumort. Hep. Eur.

On Scotch mountains.

GENUS 8. TRICHOLEA, *Dumort.*

Involucre none; perianth erect, stipitate, free, tubulose, terete, covered everywhere with hairs; apex truncate, undivided, without teeth, mouth open, circular; capsule four-valved, coriaceous, naked; elaters double, naked, deciduous. *Dum. Syll., t.* 1, *f.* 8. (1831). *Hep. Eur., t.* 3, *f.* 29.

Plants stipulate, leaves incurrent, multifid, cut into hair-like segments.

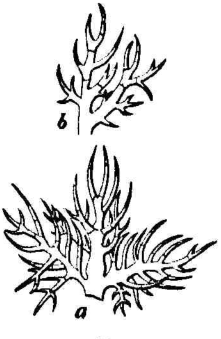
Tricholea tomentella, *Ehr.*

Stems dichotomous, thrice pinnate, leaves hair-like, multifid; stipules transversal, subquadrate, four-partite, setaceous, multifid.

Jungermannia tomentella, Ehr. Beitr. II., 150. Dicks. Crypt. II., 14; Eng. Bot. t. 2242. Hook. Br. Jung. t. 36. *Trichocolea tomentella,* Nees. Eur. III., 1057; Gott. and Rab. Exs. 52, 272; Cooke Hep. f. 129. *Tricholea tomentella,* Dumort. Comm. p. 113; Carr. and Pears. Exs. No. 10, 11.

On moist rocks. (Fr. March and June.)

Forming dense tufts, sometimes several feet in diameter, of a very pale glaucous green colour, and tomentose habit. Stems 2 to 6 inches long and flexuous, primary branches stout and forked, secondary alternately pinnate, spreading, often with shorter pinnules. Leaves spreading, much divided and subdivided into numerous hair-like segments, so as to give the plant a woolly appearance (fig. 54). Stipules subquadrate, and ciliate, between each pair of leaves (*b*). Inflorescence dioicous. Involucre clothed with tomentose bracts. Pistillidia very numerous. Capsule deep purple brown, striate. Spores dark brown. Elaters bispiral. Male shoots more



54.

Tricholea tomentella, *Ehr.*

Stems dichotomous, thrice pinnate, leaves hair-like, multifid; stipules transversal, subquadrate, four-partite, setaceous, multifid.

Jungermannia tomentella, Ehr. Beitr. II., 150. Dicks. Crypt. II., 14; Eng. Bot. t. 2242. Hook. Br. Jung. t. 36. *Trichocolea tomentella*, Nees. Eur. III., 1057; Gott. and Rab. Exs. 52, 272; Cooke Hep. f. 129. *Tricholea tomentella*, Dumort. Comm. p. 113; Carr. and Pears. Exs. No. 10, 11.

On moist rocks. (Fr. March and June.)

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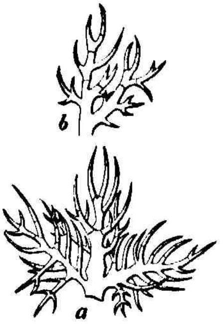


54.

slender. Perigonial leaves terminal. Antheridia large, solitary, deep green, pedicellate.

GENUS 9. ANTHELIA, *Dumort.*

Perichætium many-leaved, everywhere imbricate; perichætial leaves palmate; perianth sessile, erect, cylindrical, plicate at the apex, mouth toothed; capsule four-valved, coriaceous, naked; elaters double, naked, deciduous.—*Dumort. Rev. Jung. p.* 18 (1835). *Hep. Eur. p.* 97, *t.* 3, *f.* 23.

Plants without stipules, leaves transversal, divided, bipartite or palmate.

Anthelia julacea, *Linn.*

Stem erect, branched, leaves quadrifarious, incumbent, ovate, acutely bifid, segments lanceolate; perichætial leaves everywhere imbricate, palmate; stipules none, perianth cylindrical, plicate at the apex.

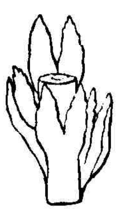
Jungermannia julacea, Linn. Sp. 1601; Hook. Br. Jung. No. 2; Engl. Bot. t. 1024; Gott. and Rab. Exs. No. 126, 152, 467; Cooke Hep. f. 103. *Anthelia julacea*, Dumort. Rev. Jung. p. 18; Carr. and Pears. Exs. No. 35.

In dense patches, in mountainous districts.

var. *gracilis*, Hook. Jung. fig. 3 and 15.

(Fig. 55.) Stem slender, rather long; leaves distant.

Barren stems procumbent, fertile erect ½ inch to 1½ inch, dirty brown colour, more or less branching. Leaves imbricated and adpressed, concealing the stem, erect, nearly ovate, flat, acutely cleft about three-fourths of length into two equal segments, which are lanceolate, acuminate, margins obscurely serrate. Perichætial leaves surround the calyx for nearly a third of its height, the interior quadripartite, the exterior resembling those of the stem but larger. Calyx plicate above, toothed or torn at the margin and paler. Calyptra ovate, dirty white. Capsule globose, shining, dark brown. Elaters bispiral.



55.

Anthelia Juratzkiana, *Limpr.*

Minute. Stems creeping, branched, branches short and clavate; leaves trifarious, deeply bifid, segments lanceolate; perichætial leaves deeply incised and dentate; perianth deeply plicate, mouth a little contracted, and dentate.

Jungermannia Juratzkiana, Limpr. Krypt. Fl. Schles. p. 288. *Jungermannia julacea v. clavuligera*, G. L. and N. Syn. Hep. 147. *Anthelia Juratzkiana*, Limp. l. c. p. 436.

In alpine regions. (Fr. July.)

Minute, monoicous. Growing in flat dense en-

tangled tufts 2-4 mm. high, of a blue green colour, brownish below, stems creeping, ascending, rigid, crowded, with short radicles beneath; branches short and clavate. Leaves *compressed, trifarious*, deeply bifid, some more expanded, shorter and broader. Cells quadrate, rectangular, rarely 5-6 angled, thin walled. Cuticle distinctly granular. Male involucral leaves two to four pairs, compressed, a little concave, very broad, mostly incised one-third of their length. Antheridia beneath the archegonia at the end of the stem or innovations, round, simple on very short peduncles. Female involucral leaves longer, deeply incised, and distinctly dentate. Perianth scarcely higher than the involucre, egg-shaped, deeply plicate, the mouth a little contracted and finely dentate. Archegonia, three to five.—(*Plate 2, fig. 28.*)

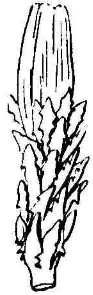
Anthelia setiformis, *Ehr.*

Stem erect, nearly simple, leaves bifarious, closely incumbent, palmate, base two-spurred, segments spinulosely toothed; stipules minute, very rarely bifid; perianth cylindrical, axillary or terminal.

Jungermannia setiformis, Ehr. Beitr. III., p. 80; Hook. Br. Jung. No. 20; Mart. Erl. p. 45, t. 4, f. 18; Gott. and Rabh. Exs. No. 96, 252; Cooke Hep. f. 89. *Anthelia setiformis*, Dumort. Rev. Jung. p. 18; Carr. and Pears. Exs. No. 120, 121.

In mountain districts.

Growing in dense matted tufts some inches broad. Stems 2 to 3 inches long, slender, of a reddish-brown colour, erect, simple, or irregularly dichotomous. Leaves bifarious, erect; adpressed, so closely imbricate as to conceal the stem, quadrate but broader than long, somewhat embracing, divided from the apex to one-fifth of the base into four equal lanceolate, erect segments, which are keeled on their inner surface, and furrowed on the outer; margins recurved, here and there beset with unequal strong teeth, generally pointed downwards. The texture rigid and brittle when dry. Colour pale yellowish brown. Perichætial leaves larger than the rest, the divisions more numerous, margins more recurved, and teeth larger, and more abundant. Calyx oblong, plicate, mouth toothed, but not contracted (fig. 56).



56.

Anthelia filum, *Dumort.*

Stem erect, nearly simple; leaves bifarious, closely incumbent, palmate, two-spurred at the base, segments entire, stipules none.

Jungermannia setiformis β alpina, Hook. Br. Jung. t. 20, f. 1, 3, 4. *Jungermannia filum*, Dumort. Syll. Jung. p. 64. *Anthelia filum*, Dumort. Rev. Jung. p. 18; Hep. Eur. p. 98.

Amongst moss.

This differs from *Anthelia setiformis* in the

leaves being divided to within one-third of the base, with the margins quite entire. It is a smaller species and more of an olive green.

Sub-tribe IV. TRIGONANTHEÆ, Spruce.

Fertile female branches in many, not in all, on the back side. Leaves alternate, rarely opposite, from the often broad, truncate apex more or less deeply two to four (rarely six) dentate, lobate; margin for the most part entire, plane or incurved (never recurved); flowers constant on posterior branches; elaters dispiral.

This sub-tribe is, with very rare exceptions, well distinguished from the two preceding ones by the female flowers being hypogenous, or postical, usually on a branch shortened down to the floral envelopes alone. Not only are the female branches mostly postical, but normally leafy branches, having the same origin, exist in nearly every genus; and in some genera all the branches—leafy, floriferous and radicelliferous—are solely postical. The trigonous perianth (with the third angle on the under side), usually so constricted upwards as to end in a narrow pyramid, prevails nearly throughout the *Trigonantheæ*.

The equably tristichous foliage, which with few exceptions prevails throughout the *Ptilidieæ*, has no parallel in *Trigonantheæ*, and rarely any approach to it.—*Spruce.*

GENUS 10. **PLEUROZIA**, *Dumort.*

Involucre two-leaved, leaves deeply two-lobed, the upper broad and convolute. Perianth long, cylindrical, mouth denticulate, apex plicate and decurved. Capsule four-valved, coriaceous, naked. Elaters geminate, naked, deciduous.—*Dumort. Rev. Jung.* (1835), *p.* 15. Physiotium, *Nees Eur. Leb.* (1838), III., 75.

Leaves without stipules, lower auriculate, the auricles inflated.

Pleurozia cochleariformis, *Weiss.*, *Dumort.*

Leaves rounded, shell-shaped, convex, bifid at the apex, serrate, auricle oblong-ovate, inflated. Perianth subcylindrical, mouth dentate.

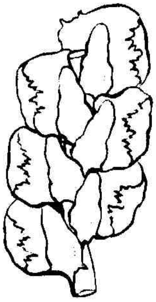
Lichenastrum alpinum, Dill. Musc. 479, t. 69, fig. 1. *Jungermannia cochleariformis*, Weiss. Crypt. 123; Eng. Bot. t. 2500; Hook. Br. Jung. No. 68. *Physiotium cochleariforme*, Nees Eur. Leb. p. 79; Carr. and Pears. Exs. No. 40, 41; Cooke Hep. f. 127, 128. *Pleurozia cochleariformis*, Dum. Rev. Jung. p. 15; Dum. Hep. Eur. p. 52.

In bogs on Alpine moors.

Growing in large loosely-tangled patches, many inches broad, stems procumbent, but, when crowded, erect, 4 to 6 inches long, flexuous, simple, or h...

and there innovant, yellowish-brown (fig. 57). Leaves closely placed and imbricated alternately over the whole upper surface, concealing the stem, convex, distichous, apices incurved and turned one way, as do occasionally the whole of the leaves when fresh, always when dry; form roundish or ovate, upper margin, near its insertion upon the stem, furnished with one or two spiny processes or teeth, at the apex divided by an acute sinus into two serrated lobes. At the lower base is the auricle, an ovate inflated pouch-like appendage, one-fourth the size of the leaf. Colour of a fine purple towards the apex, browner at the base, auricles greenish-brown (fig. 58).

57.



58.

Genus 11. BAZZANIA, *Gray*.

Involucre many-leaved, leaves everywhere imbricate, scale-like, undivided, margin serrulate. Perianth sessile, erect, elongate, terete or rather triangular, longer than the calyptra, apex split and strap-like, mouth toothed. Capsule four-valved, coriaceous, naked; elaters double, naked, deciduous.—*Gray Arr. I.*, 704. Pleurochisma, *Dumort. Hep. Eur.*, *t.* 3.

Plants stipulate, rarely without stipules, leaves incurrent, divided.

"The species of this genus are a standing puzzle to hepaticologists. They are all so alike in habit, and in their more obvious characters, that a casual observer would unhesitatingly refer them to the same genus; but when we try to define the species, we find it difficult to assign them positive limits." —*Spruce Hep. Amaz. p. 368.*

Bazzania trilobata, *Linn.*

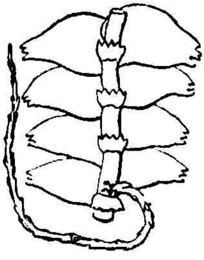
Stem creeping, branched, leaves imbricate, convex, ovate, apex truncate, three-toothed, stipules broadly quadrate, three to five toothed, six times shorter than the leaves.

Jungermannia trilobata, Linn. Sp. 1599. Hook. Br. Jung. t. 76; Gott. and Rab. Exs. 18, 280. *Jungermannia radicans*, Hoffm. Eng. Bot. t. 2232. *Mastigobryum trilobatum*, Nees Syn. Hep. 231; Cooke Hep. f. 125. *Pleurochisma trilobatum*, Dumort. Syll. Jung. p. 70. *Bazzania trilobata*, Carr. and Pears. Exs. No. 39, 187.

In mountainous districts.

Growing in large dense patches, sometimes exceeding a foot. Stems 3 to 5 inches long, creeping horizontally upon the ground, sometimes simple, innovant, at others dichotomously branched, brownish. Flagellæ about an inch long, from the

under side of the stem, numerous, beset with minute scales, jagged at the apex. Leaves more or less close and imbricate, horizontal, in two rows, attenuated, ovate, cut at the apex into three obtuse teeth ; surface a little shining, olive green. Perichætial leaves embracing the base of the calyx, composed of small ovate scales jagged at the apex. Calyx oblong, narrower upwards, mouth slit on one side, destitute of teeth, nearly white. Capsule ovate, dark shining brown. Elaters bispiral (fig. 59).



59.

Bazzania triangularis, *Schl.*

Stem creeping, branched, leaves imbricate, obliquely ovate, convex, apices crenate in front, stipules orbicular, emarginate and dentate, plane.

Jungermannia triangularis, Schleich. II., No. 61. *Jungermannia deflexa*, Mart. Erl. t. 3, f. 8. *Pleurochisma deflexum*, Dumort. Syll. Jung. 71. *Mastigobryum deflexum*, Nees Syn. Hep. 231 ; Cooke Hep. f. 126. *Bazzania triangularis*, Carr. in sched.

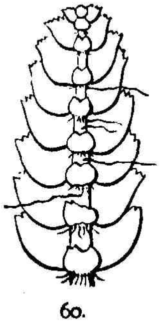
var. *α tricrenata*, Nees. Stem branched, branches not divergent, leaves imbricate,

ovate-falcate, decurved arcuately from the base, apex three-toothed, stipules repand, crenate.

Jungermannia trilobata, β minor, Hook. Jung. t. 76. *Jungermannia tricrenata*, Wahl. Fl. Carp. p. 364. *Bazzania tricrenata*, Carr. and Pears. Exs. 122, 123, 266. *Mastigobryum deflexum* α *tricrenatum*, Carr. Irish Crypt.

Var. β *innovans*, Nees Carr. and Pears. Exs. No. 124. One or two slender innovations from the apex, the lower branches now and then flagellately attenuated, leaves entire or deeply tridentate, with oblique unequal teeth, stipules convex, entire or deeply bifid.

Mastigobryum deflexum, var. β 2, *innovans*, Nees G. L. and N., Syn. Hep. p. 232.



60.

Stem furcately or alternately branched, leaves very much deflexed, cordate-ovate or oblong-ovate, falcate, dorsal margin arcuate, narrow at the apex, either two or three toothed, or entire with the teeth quite entire; stipules approximate, quadrate-rounded, margin above either bifid or crenate or entire; perianth cylindrical, arcuate, plicate at the apex, mouth denticulate and split (fig. 60).

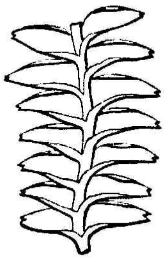
Bazzania Donniana, *Hook.*

Stem erect, nearly simple, flexuous; leaves falcate-secund, triangularly ovate, margin revolute, bidentate at the apex; stipules none; perianth terminal, ovate, plicate, mouth laciniate.

Jungermannia Donniana, Hook. Br. Jung. No. 39; Eng. Bot. t. 2566; Cooke Hep. f. 84. *Jungermannia trilobata*, var. Hook. Fl. Scot. II., 117. *Pleuroschisma Donnianum*. Dumort. Syll. Jung. p. 72.

Amongst moss on Mountains.

Growing in small loose tufts. Stems 1 to 2 or 3 inches long, erect, thread-like, flexuous, but fragile, purplish-brown, simple, or with one or two scattered shoots. Leaves closely imbricated, bifarious, oblong ovate, very concave, margin often incurved (fig. 61), slightly decurrent at the base, divided at the apex by an acute sinus, which is often concealed by overlapping, forming two small obtuse teeth, deep purplish brown. Calyx ovate, plicate above, with a slightly-toothed mouth.



61.

GENUS 12. KANTIA, *Gray.*

Involucre none; perianth affixed laterally

by the margin of the apex, saccate, pendulous, mouth funnel-shaped, lobate, everywhere hairy with erect setæ, bearded at insertion; capsule spiral, naked, four-valved, valves spirally contorted; elaters double, naked, deciduous.—*Gray Arr. I.*, 706 (1821). Spruce Hep. Amaz. p. 409. Cincinnulus, *Dumort. Hep. Eur. p.* 115, *t.* 3, *f.* 32.

Plants stipulate, leaves incurrent, entire or emarginate.

Spruce says that although it is exceedingly probable that *Kantia* is a marsupial form of *Trigonantheæ*, it is difficult to fix on any one genus of that tribe of which it may be the direct descendant. Its nearest existing ally seems to be *Bazzania*. *Kantia* agrees with *Cephalozia* in having all the branches, whether foliiferous or floriferous, postical, axillary to the under leaves, in the monandrous male bracts, and the two-layered capsule.

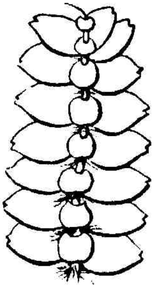
Kantia trichomanis, *Dicks.*

Stem creeping, branched; leaves entire and emarginate; stipules orbicular, lunate-emarginate; calyx pendulous; capsule four-valved, twisted.

Jungermannia trichomanis, Dicks. Crypt. III., t. 8, f. 5; Hook. Br. Jung. t. 79; Eng. Bot. t. 1835. *Cincinnulus trichomanis*, Dumort. Comm. p. 113. *Calopogeia trichomanis*, Corda Opiz. p. 653; Cooke Hep. f. 119. *Kantia trichomanis*, Carr. and Pears. Exs. 126, 267.

Common in moist woods, heaths, and moors. Summer.

Growing in dense or scattered patches. Stems 1 to 2 inches long, slender, procumbent, simple or innovant, pale green. Leaves rather close and imbricate, so as to conceal the stem, small at the base and extremity, largest in the middle, horizontal, widely ovate, convex above, many entire, others cleft with a wide obtuse notch at the apex, without serratures, pale glaucous green (fig. 62). Stipules one to each pair of leaves, roundish, with a deep, somewhat lunate, notch at the apex. Calyx attached by one side of its mouth to a short foot-stalk, so that the rest is pendent, and imbedded in the soil, oblong, obtuse, fleshy, covered externally with rather long hairs, pointing upwards. Capsule linear-oblong having the four valves twisted in a spiral (fig. 63). Elaters bispiral.—(*Plate 2, fig. 22.*)



62.

63.

var. α *repanda,* Nees Eng. Bot. t. 1875. Leaves evidently bidentate, subrepand, stipules broad, narrowly bifid, laciniæ rather acute.

On moist banks.

Kantia arguta, *Nees.*

Stem creeping, somewhat branched; leaves

subimbricate, horizontal, subquadrate, rounded at the apex, and acutely multidentate ; stipules deeply bifid ; laciniæ awl-shaped, divergent ; perianth triquetrous, mouth three-lobed, dentate.

Calypogeia arguta, Mont. and Nees Eur. Leb. 3, p. 24. *Cincinnulus argutus,* Dumort. Hep. Eur. p. 117. *Kantia arguta,* Carr. and Pears. Exs. No. 188, 189; Gott. and Rab., Ex.! 167.

On trunks.

Stems 2 to 3 inches long, sparingly branched, innovant. Leaves very variable on the same stem, subquadrate, or elongated subquadrate, rounded at the apex, armed with acute teeth, at the base of the stem a little broader, in others more ovate, and the apex (without the teeth) truncate, leaves of young shoots bidentate, or tridentate, plane, different from the leaves of the adult plant. In the adult plant the apex of the leaves is armed with five or six (even seven) teeth, which are curved or connivent. Stipules everywhere with one side decurrent with the subjacent leaf, bipartite, segments lanceolate. Fructification ventral, on a very short branch. Involucral leaves similar to the cauline, but a little smaller, involucral stipules larger than the cauline, quadridentate, subinvolucral leaves not half the size of the cauline. Perianth obovate, or cylindrical and three-cornered, angles sometimes prominent, sometimes obsolete, mouth three-lobed dentate.—(*Plate 2, fig. 30.*)

GENUS 13. LEPIDOZIA, *Dumort.*

Involucre many-leaved ; leaves everywhere imbricate, scale-like, undivided, apex toothed perianth erect, sessile, terete, longer than the calyptra, trisulcate, elongated, hyaline, segments dentate at the apex ; capsule four-valved, coriaceous, naked ; elaters double naked, deciduous.—*Dumort. Rev. Jung.* 19 (1835). *Hep. Eur.* 109, *t.* 3, *f.* 28.

Plants stipulate, flagelliferous, leaves incurrent divided.

Lepidozia reptans, *Linn.*

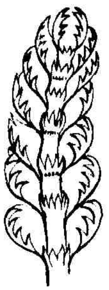
Stem creeping, branched, flagelliferous leaves subquadrate, incurved, apex acutely four-toothed ; stipules broadly quadrate, 2-4-fid, perichætial leaves ovate, unequally four-toothed.

Jungermannia reptans, Linn. Sp. 1599. Eng. Bot. t. 608 ; Hook. Br. Jung. No. 75. *Lepidozia reptans*, Dum. Rev. Jung. p. 19. Carr. and Pears. Exs. No. 268 ; Gott. and Rab. Exs. 19, 282, 479 ; Cooke Hep. f. 121.

In woods, on banks, and shady places. (Fr. Spr. and Sum.)

Covering the soil in dense tufts, or straggling

amongst mosses. Stems creeping, horizontal ½ to 1½ inch long, thread-like, flexuous, greenish or yellowish, irregularly branched, growing in a stellate manner, branches beset with spreading or horizontal pinnæ, extremities sometimes obtuse, sometimes attenuated, under side of the stem bearing flagellæ. Leaves imbricated on the upper surface, closely so, for the most part, but on the branches and innovations more distant and smaller, all spreading or horizontal, pointing a little to the end of the branch, nearly quadrate, convex, incurved at the apex, divided into four (or three, and sometimes five) acute teeth (fig. 64). Colour pale green, perichætial leaves six or eight at the base of each calyx, exterior the smallest, all ovate, convex, and cut into three or four small teeth at the apex, nearly white. Stipules twice the width of the stem, somewhat quadrate, very convex, deeply cut into four acute segments. Calyx sub-membranaceous, nearly white, oblong, somewhat plicate at the apex, mouth dentate, capsule deep brown. Elaters bispiral.



64.

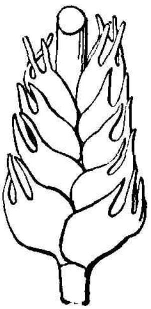
Lepidozia tumidula, *Tayl.*

Stem procumbent, bipinnate, branches decurved, flagelliform, leaves closely imbricate, vertical, obliquely rounded-quadrate, quadrifid, segments acuminate, ascending; stipules rounded-quadrate or subcordate, convex, spreading, quadrifid, entire.

Jungermannia reptans β pinnata, Hook. Jung., t. 75, f. 12. *Lepidozia tumidula*, Tayl. in Nees Syn. Hep. p. 206 ; Spruce Hep. Amaz. p. 361 ; Gott. and Rabh. Exs. No. 214. Cooke Hep. Figs. 123, 124. *Lepidozia pinnata*, Dumort. Hep. Eur. 110. *Lepidozia cupressina β tumidula*, Lindb. Trans. Bot. Soc. Edin. VII., 453, t. xi., f. 7 ; Carr. and Pears. Exs. 38, 269, 270.

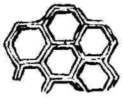
Forming dense cream-coloured cushions on ledges of rocks and trees.

This species is said to differ from *L. cupressina* in the bipinnate, less attenuated ramuli, and broader leaves. Irish specimens vary much both as to size, ramification, and shape of the leaves. Some stems are distantly and irregularly branched, and scarcely distinguishable from *L. reptans*, while others are densely pinnate, bi- or even tri-pinnate, according to age and luxuriance, new stems springing from the old in a proliferous manner. The involucral leaves are variable in shape, obtusely tridentate, the central tooth reflexed, with larger rhomboid areolæ than on the stem leaves. From *L. reptans* it is distinguished by the dense erect habit (fig. 65), closely pinnate ramuli, subvertical cordate leaves, which, like the stipules, are quadrifid (fig. 67), the ventral teeth inflexed, areolæ

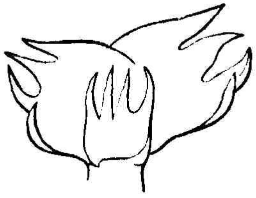


65.

smaller, hexagonal (fig. 66); whereas in *L. reptans* the ramification is more lax, leaves less imbricated, nearly horizontal, ovate quadrate and tridentate, and the cells are very conspicuous, roundish, with thick walls.—*Carrington.*



66.



67.

Lepidozia Pearsoni, *Spruce.*

Dioicous. Stems creeping, simple then loosely pinnate, branches short, axillary, leaves small, subquadrate, palmatifid, laciniæ four to six, rather distant, stipules with four to five teeth, which are subulate and incurved. Male flowers apical on a branch, bracts three to ten, smaller than the leaves.

Lepidozia reptans, Carr. and Pears. Exs. No. 37. *Lepidozia Pearsoni,* Spruce Journ. Bot., 1881, XIX., p. 34; Carr. and Pears. Exs. No. 190.

Loosely creeping amongst other hepatics.

Dioicous. Creeping, pallid green, then tawny, stems 2 to 3 inches, subterete, simple or furcate, then loosely pinnate; branches short, or of unequal length, simple, very rarely branched, some with the

apex flagellate, small-leaved. All the branches lateral axillary. Leaves small, cauline distant, rarely rather contiguous, obliquely incubous, subquadrate, palmatifid to the middle, laciniæ for the most part four, rarely five or six subulate, rather acuminate, incurved uncinate, three to five cells broad at the base. Leaves of the branches smaller, 3-4-fid, the upper bifid, leaves of the branchlets longer and narrower, deeply bifid. Stipules shorter than the leaves, cut half way into four or five, rarely six, teeth, broadly subulate, obtuse and incurved. Flowers dioicous, male spicate at the apex of a branch, bracts three to ten, smaller than the leaves, imbricate, bilobate, concave, rarely with a basal tooth, lobes ovate, acute, incurved, bracteoles narrower, bilobed. Antheridia solitary, shortly stipitate.—(*Plate 2, fig. 31.*)

Lepidozia setacea, *Web.*

Stem creeping, branched, leaves everywhere imbricate, bipartite nearly to the base, setaceous, incurved, articulate, perichætial leaves dissected, stipules none. Perianth lateral, oblong, mouth open, ciliate.

Jungermannia setacea, Web. Spic. Gott. 145; Hook. Br. Jung. No. 8; Engl. Bot. t. 2482; Gott. and Rabh. Exs. 38, 39, 114, 445, 502. *Lepidozia setacea*, Cooke Hep. f. 120; Carr. and Pears. Exs. No. 191, 192. *Blepharostoma setacea*, Dumort. Rev. Jung. p. 18; Dumort. Hep. Eur. 95. *Jungermannia pauciflora*,

Dicks. Crypt. II., 15, t. 5, f. 9. *Jungermannia multiflora*, Huds. Fl. Ang., p. 510.

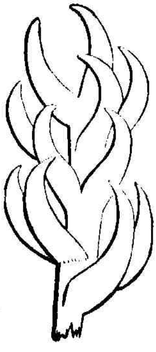
In bogs, &c. (Fr. Autumn.)

var. β *sertularioides*, Nees. Elongated, remotely and simply pinnate, pallid, leaves distant.

Amongst sphagnum.

var. γ *Schultzii*. Cæspitose, leaves crowded, imbricate. *Lepidozia setacea* v. *Schultzii*, Carr. and Pears. Exs. No. 193.

Sometimes in dense tufts, but frequently scattered. Stems creeping, from ¼ to 2 inches or more, irregularly forked, with irregular pinnate branches, which are short and spreading. Leaves generally in pairs, sometimes three together, on every side of the branch (fig. 68), minute, setaceous, spreading, incurved, transversely septate; generally of a pale yellowish green, sometimes brownish. Perigonial leaves thickly clustered in a sphærical manner, the exterior simple, the interior rising from a broad base, divided above into a number of narrow laciniæ. Perichætial leaves closely adpressed, oblong-ovate, divided nearly to the base into narrow laciniæ. Perianth small, cylindrical, pellucid, mouth ciliate; capsule ovate, furrowed. Elaters bispiral.



68.

GENUS 14. BLEPHAROSTOMA, *Dumort.*

Involucre many-leaved, everywhere imbricate, perichætial leaves articulate-ciliate. Perianth sessile, erect, terete, ovoid, naked, mouth clad with long articulate cilia. Capsule four-valved, coriaceous, naked. Elaters double, naked, deciduous.—*Dumort. Rev. Jung.* p. 18. (1835.)

Plants delicate, without stipules, leaves transversally or vertically plane, or parted nearly to the base, segments setaceous.

"*Blepharostoma*, although at first sight so different from *Cephalozia* in the quadripartite leaves, with filiform crura, has the involucre and perianth formed on the same plan, the bracts being tristichous and mostly trijugous, and the perianth, when young, distinctly trigonous (with the third angle postical), although at maturity it becomes nearly terete, and is trigonous only at the many-ciliated apex. The dichotomous ramification, without a single postical branch, and the constantly terminal female flowers separate it from *Cephalozia* and assimilate it to Pleuroclada."—*Spruce on Cephalozia, p. 16.*

Blepharostoma trichophylla, *Linn.*

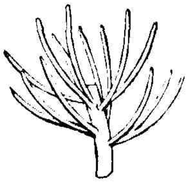
Stem creeping, branched, leaves everywhere imbricate, three-parted nearly to the base, setaceous, nearly erect, articulate, perichætial

leaves dissected, stipules none. Perianth terminal, ovate, mouth contracted, ciliate.

Jungermannia trichophylla, Linn. Sp. 1601; Eng. Bot. t. 2252; Hook. Br. Jung. No. 7; Mart. Erl. p. 146, t. 4, f. 21; Gott. and Rabh. Exs. 15, 267, 313; Cooke Hep. f. 102. *Blepharostoma trichophylla*, Dumort. Rev. Jung. p. 18; Carr. and Pears. Exs. 118, 119.

On turfy heaths, &c.

Growing in loose matted tufts, some inches broad. Stems creeping ½ to 1½ inch long, simple or forked, shoots with short spreading branches. Leaves in alternate clusters of two or three to five, forming tufts, simple or forked, setaceous, straight, yellowish green, paler when dry, transversely septate (fig. 69) Perichætial leaves, external similar to stem leaves, internal nearly ovate, entire at the base, but divided above into branched capillary segments. Perianth elliptical, plicate, contracted at the mouth, and fringed with short hairs. Calyptra ovate, white. Capsule ovate, then splitting into four lanceolate segments, longitudinally and transversely furrowed. Elaters bispiral.



69.

GENUS 15. **CEPHALOZIA**, *Dumort.*

Plants small and tender, stems usually prostrate, branches all postical, leaves mostly

succubous, horizontal, never deflexed, mostly bilobate, margins plane or subincurved, never recurved. Inflorescence uniformly monandrous. Gynæcia capitate, cladocarpous or acrocarpous, bracts tristichous, perianth free, trigonous, third angle always postical, calyptra free, capsule on a long pedicel. Elaters bispiral.—*Dum. Hep. Eur.* 87. *Spruce on Cephalozia, p.* 6.

Spruce divides the genus into the following subgenera, some of which are not represented in Britain—viz., *Protocephalozia, Pteropsiella, Zoopsis, Alobiella, Eu-cephalozia, Lembidium, Odontochisma, Cephaloziella.*

SUB-GENUS. EU-CEPHALOZIA, *Spruce.*

Cephalozia catenulata, *Hub.*

Stems ascending, branches abbreviated, leaves half embracing the stem, bifarious, ovate, concave, acutely bifid; perichætial leaves multifarious, 2-3-fid. Perianth longitudinally plicate, mouth gaping, ciliate.

Jungermannia catenulata, Hub. Hep. Germ. p. 169; Gott. and Rabh. Exs. No. 433, 496; Carr. and Pears. Exs. No. 115, 116, 250; Carr. Irish Crypt. t. xi., f. 2; Cooke fig. 94. *Cephalozia catenulata*, Lindb. Linn. Journ. XIII., p. 191; Dumort. Hep. Eur. 92. *Jungermannia reclusa*, Tayl. Trans. Bot. Soc. Edin. II., 44;

Lond. Journ. Bot. V., 278. *Cephalozia reclusa*, Dumort. Hep. Eur. p. 92.

On rotten trunks and sand rocks.

Tufts shallow, extensive, olive brown; stems rigid, terete, flexuose, catenulate; leaves scarcely broader than the stem, roundish quadrate, upper ones erect, lower semivertical, secund, all concave, adpressed (fig. 70), divided about half way by a rather obtuse sinus, the segments acute. Fruit terminal, on short branches, perichætial leaves 1-2-3-fid, adpressed, entire. Perianth lanceolate, trigonous, apex minutely toothed; capsule elliptical, brown.

As to the identity of *Jungermannia reclusa* (Tayl.) and *Cephalozia catenulata* (Hüb.), Dr. Carrington and Dr. Spruce appear to have entertained no doubt, see notes by the former, on "Irish Cryptogams," in which appears Spruce's decision on the subject.

70.

var. γ *pallida*, Spr. Pale green or yellowish, branched, with subfastigiate branches, leaves subdecurrent, split one-third to one-half, segments obtuse, cells a little larger, bracts quite entire.—*Spruce Cephalozia, p.* 33.

Cephalozia multiflora, *Spruce.*

Bright or pale green; stems branched, rather compressed, plane above, convex below; leaves small, rhomboid, rounded, bifid

one-third; dioicous; bracts tristichous, bifid or trifid; mature perianth trigonous, mouth constricted and toothed, fleshy.

Jungermannia connivens v. *laxa* and *sphagnorum*, Nees. *J. connivens* v. *symbolica*, Gott and Rab. Exs. 62, 64. *Jungermannia bicuspidata* β *gracillima*, Nees Hep. Eur. *Cephalozia multiflora*, Spruce Cephalozia p. 38; Carr. and Pears. Exs. 114, 173, 174, 251.

On shady heathy banks, and on trunks.—(*Plate 2, fig. 23.*)

Dioicous, cladocarpous, without flagellæ, bright or pallid green, densely and depressedly cæspitose, or creeping amongst *Sphagnum*, prostrate, branched, sometimes subpinnate, branches radicellose, ascending. Stems subcompressed, plane above, convex below. Leaves small, rather imbricate, in sterile plant distant, ascending, rhomboid rounded, decurved in front, bifid one-third, sinus obtuse, rarely lunate, segments connivent, acute or subacuminate, cellules medium sized, pellucid, quadrate hexagonal, inferior rather largest. Flowers dioicous, females terminal on short branches. Bracts tristichous, oblong, rounded, bifid for one-third, rarely trifid, or twice bifid, segments acute, entire, bracteoles similar, sometimes connate with the bracts. Perianth linear-fusiform, triplicate when young, when adult three-angled at the apex, mouth rather constricted, toothed or setulose, fleshy. Calyptra twice as short, globose-oval, fleshy. Capsule oblong cylindrical. Spores cinnamon. Andræcia at the apex of the branches, bracts subsecund, equal

in size to the leaves, bifid half way, antheridia solitary.

var. *β elata*, *Spruce*. Larger, pallid green, more branched, leaves denser, segments longer, acuminate, incurved.

Cephalozia bicuspidata, *Linn.*

Stem creeping, branched; leaves incumbent, lax, subquadrate, bicuspidate, with an acute sinus; perichætial leaves 2-3-fid, everywhere imbricate; stipules none; perianth terminal on lateral branches, cylindrical.

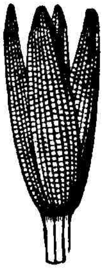
Jungermannia bicuspidata, Linn. Sp. 1589; Hook. Br. Jung. pl. 11; Eng. Bot. t. 1304, 2239; Gott. and Rabh. Exs. 74, 191, 289, 308, 309, 353; Cooke Hep. f. 95, 96. *Cephalozia bicuspidata*, Dumort. Rev. Jung. p. 18; Lindb. Linn. Journ. XIII., 91; Carr. and Pears. Exs. No. 112, 113, 175, 253.

On moist hedge banks and heaths. (Fr. Spring.)

Growing in large tufts, loosely attached, pale green. Stems procumbent, flexuous, 1 to 1½ inch long, branching in a radiate manner. Leaves rather distant, spreading or nearly erect (fig. 71), oblong quadrate, divided one-third or more by an acute sinus into two lanceolate equal acute segments, now and then a little incurved. Perichætial leaves numerous and closely imbricated, the in-

71

terior the largest, generally acutely bifid, the exterior frequently trifid, the points sometimes recurved. Calyx oblong, longitudinally plicate, mouth irregularly toothed. Calyptra ovate, whitish. Capsule deep brown, longitudinally and transversely furrowed (fig. 72). Elaters bispiral.


72.

This exceedingly variable species has been met with in Britain under the following forms :—

Sect. A.—Leaves of the sterile branches more or less distant.

var. α *vulgaris*. Leaves broader than the diameter of the branches, plane, subdistichous.

form * *major*.

form ** *patens*. Laciniæ of the lower leaves divergent.

var. β *rigidula*. Leaves equal to the diameter of the branch, rather rigid, concave, spreading, bifid to the middle, the laciniæ divergent.

Sect B.—Leaves of the sterile branches closely imbricate, hence more or less julaceous.

var. β *curvifolia*, Hook. Jung. t. xvi. Perianth frequently obovate, or more inflated than usual.

var. γ *ericetorum*, Nees (exclusive of *J. reclusa*). Sterile branches short,

depressed, or somewhat erect, rather rigid.

var. *tenuirama*, Carr. and Pears. Exs. No. 252.

Spruce cites two varieties:—

var. 1 *grandiflora*, Spruce. Luxuriant, female bracts large, squarrosely recurved, often distinctly laciniate.

var. 2 *setulosa*, Spruce. Small; leaves small, lobes subapiculate, mouth of perianth setulose, laciniæ of bracts broadly subulate, acuminate, with one or two spines on either side.

Cephalozia Lammersiana, *Hub.*

Colour whitish or lurid, flagella rare; branches stout; leaves very concave, rigid, subdistichous, spreading, approximate; inflorescence dioicous; female flowers terminal on long branches.

Cephalozia Lammersiana, Hub. Hepat. Germ. p. 165; Carr. and Pears. Exs. No. 254, 255, 256; Spruce Ceph. p. 43. *Cephalozia bicuspidata* var. *Lammersiana*, Auct. *Jungermannia bicuspidata*, Eng. Bot. t. 2239.

In swampy places, &c.

Differs from *C. bicuspidata* in being two or three times higher, colour whitish or lurid, never roseate; flagellæ none or very rare, laciniæ of the leaves

more unequal and acuminate, stipules more frequent chiefly on male plants. Inflorescence dioicous, female always terminal on elongated branches; lateral bracts more deeply cut, laciniæ entire. Perianth larger.—(*Plate 6, fig. 27.*)

Spruce says that this can hardly be considered more than the dioicous and perfect form of *Cephalozia bicuspidata*. Whether species, subspecies, or variety, it is easy to distinguish from *bicuspidata* by its much larger size, tufted growth, absence of flagellæ, dioicous, inflorescence, and the female flowers terminating long branches.

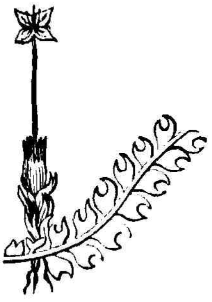
Cephalozia connivens, *Dicks.*

Stem creeping, branched, leaves accumbent, suborbicular, lunular-emarginate, bifid, laciniæ incurved, connivent, perichætial leaves everywhere imbricate, 3-4-fid, stipules none; perianth terminal on lateral branches, ovate, mouth ciliate.

Jungermannia connivens, Dicks. Crypt. IV., p. 19, t. 11, f. 15; Hook. Br. Jung. No. 15; Eng. Bot. t. 2436; Gott. and Rabh. Exs. No. 111, 175, 239, 380, 473; Cooke Hep. fig. 97. *Blepharostoma connivens*, Dumort. Rev. Jung. p. 18. *Cephalozia connivens*, Lindb. Spruce Ceph. p. 46; Carr. and Pears. Exs. No. 117.

In boggy places. (Fr. April, May.)

Growing in small loose patches, pale yellowish green. Stems thread-like, flexuous, procumbent, ½ to 1 inch or more, semi-pellucid, delicate, branched in a somewhat stellate manner, branches again subdivided. Leaves bifarious, erect or spreading, more or less distant, minute, orbicular, decurrent at the base, concave above, convex below, cleft at the apex by an orbicular notch, hence the segments are connivent (fig. 73). Perichætial leaves five to ten, the exterior bifid or trifid, with linear lanceolate straight segments, the intermediate more oblong and trifid, th einterior oblong, divided into four or five linear erect segments, so as to be almost palmate. Calyx oblong-ovate, attenuated at the base, semi-transparent, mouth contracted, ciliate. Calyptra ovate, whitish. Capsule ovate, deep brown. Elaters bispiral.



73.

Cephalozia curvifolia, *Dicks.*

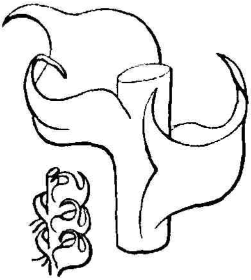
Stem creeping, branched, leaves semi-vertical, erect, rather rounded, concave, lunate, segments incurved and cornute; perichætial leaves everywhere imbricate; stipules none; perianth terminal on lateral branches, oblong.

Jungermannia curvifolia, Dicks. Crypt. II., p. 13, t. 5, f. 7; Hook. Br. Jung. t. 15, suppl. t. 1; Mack. Hib. II., 60; Gott. and Rabh.

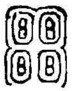
Exs. 72, 73, 217, 250, 232; Cooke Hep. f. 98, 99; Carr. and Pears. Exs. 34. *Cephalozia curvifolia*, Dumort. Rev. Jung. 18; Carr. and Pears. Exs. No. 257, 258; Spruce Cephalozia p. 47.

On dead wood, rocks, &c.

Forming small loose patches of a deep purple colour. Stems $\frac{1}{2}$ to $\frac{3}{4}$ inch long, stellately branched, procumbent, flexuous, branches simple, or forked, delicate, flexible. Leaves rather closely placed, bifarious, remarkably concave, roundish, approaching to ovate, broader than long, divided half way down from the apex by a rather obtuse sinus, segments acuminate, incurved in a striking manner (figs. 74, 75). Cells oblong with a pellucid border (fig. 76). Perichætial leaves six or seven, resembling the rest, but the segments less acuminate, and not incurved. Calyx oblong or oblong-ovate, a little plicate above, mouth somewhat contracted, with a few short teeth. Capsule ovate, deep brown. Elaters bispiral.



74. 75.



76.

Dr. Carrington contends that this is the most distinct and least variable of all the bicuspidate species. Eng. Bot. t. 1304, and Hooker's Jung. t. xvi., both represent states of *C. bicuspidata*.

It occurs in neat compact strata, the stems

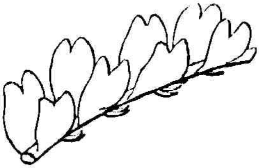
gracile, of equal width throughout, and from the convexity of the leaves looking like strings of small beads. These have a silky lustre, and are usually of a bright pink or claret colour, but sometimes pale green. The leaves are vertical, unsymmetrical, cordate, broader than long, very convex, conduplicate, gibbous posteriorly, with the margin inflexed and tumid, bicornute, the ventral tooth not continuous with the border, but arising at some distance within it, segments long and curved like the horns of an ox. The axillary leaves are cordate-lanceolate, and have only one tooth, while in the perichætial leaves there are two shorter dentate segments. The texture is thin and silky, the areolæ quadrate, discrete, surrounded by a pellucid border.

Cephalozia Francisci, *Hook.*

Stem rather erect, somewhat branched, leaves incumbent, ovate, acutely emarginate; perichætial leaves everywhere imbricate; stipules ovate, bifid; perianth terminal on lateral branches, oblong-cylindrical.

Jungermannia Francisci, Hook. Br. Jung. No. 49; Eng. Bot. t. 2569; Mack. Hib. II., 64; Gott. and Rab. Exs. 503; Cooke Hep. f. 90. *Cephalozia Francisci*, Dum. Rev. Jung. p. 18; Lind. Journ. Linn. Soc. XIII., 191; Carr. and Pears. Exs. No. 176, 177; Spruce Cephalozia p. 49.

In moist places on the ground. (Fr. Spring.) Growing in small rather densely crowded patches of pale green colour, with a faint tinge of purple.



77.

Stems five to six lines long, slender, thread-like, flexuous, simple below, and usually bare, simple above or once or twice divided, with narrow branches, usually erect, sometimes procumbent, pale yellowish green. Leaves bifarious, alternate, more or less close, usually a little imbricated, erect or rather spreading, ovate, concave, cleft acutely from the apex, for about one-fourth, into two equal, somewhat obtuse, segments (fig. 77). Perichætial leaves seven or eight, increasing in size upwards to the insertion of the calyx, where they are twice or thrice the length of the cauline leaves, imbricated, oblong, subquadrate, concave or semi-cylindrical; at the apex deeply notched, segments acute, sometimes divaricate. Stipules small, plane and adpressed, or projecting a little, ovate, cut by an acute sinus at the apex into two sharp segments. Calyx a little attenuated at the base, slightly narrowed above and plicate, mouth small and toothed. Capsule brown, quadrivalvular. Elaters bispiral.

Cephalozia fluitans, *Nees.*

Stem long, sometimes very long, rooting by numerous stout flagella, floating in water, branches all postical. Leaves distant, lax, pallid, long and narrow, under-leaves con-

stantly present, inflorescence cladocarpous; female bracts tristichous, toothed at the base, innermost embracing the perianth, which latter is thin, linear-fusiform, trigonous.

Jungermannia fluitans, Nees Syn. p. 129. Lindbg. Sp. p. 76. *Jungermannia Francisci*, Eng. Bot. t. 2569. *Gymnocolea inflata* v. *fluitans*, Dum. Hep. Eur. 65. *Cephalozia fluitans*, Carr. and Pears. Exs. No. 178, a b c, 259, 260; Spruce Cephalozia p. 50.

In the wettest part of bogs.

Dioicous, bright green, here and there rufous, rarely rosy. Stems elongate, 2 to 3 inches, laxly creeping, a little branched, rooting by rather short thick flagella. Leaves assurgent, subsecund, distant, inserted obliquely, oval ovate or oblong, now and then rather cuneate at the base, a little concave, bilobate at the apex ⅓ - ¼ way (sometimes trilobate) sinus narrow, acute, lobes unequal, postical largest, lanceolate, rather obtuse, margin repand, cellules rather large, hexagonal, stipules distant, adpressed to the stem, three times shorter than the leaves, six times as long as broad, linear bifid, laciniæ of unequal length, margin 1 - 2 dentate. Flowers dioicous, bracts tristichous, inner erect, ovate, oblong, bilobed to the middle, lobes acute, 1 - 2 dentate at the base, outer three times smaller, unequally bidentate, or falcate and entire. Perianth longer than involucre, oval-cylindrical, trigonous at the apex, mouth truncate, almost toothless. Capsule pellucid, purplish, oblong, with four linear lanceolate valves. Elaters bispiral. Spores minutely rough.

Male catkins on postical branches. Antheridia solitary.—(*Plate 4, fig. 61.*)

Cephalozia heterostipa, *Spruce.*

Stems stout, radicellose, bifurcate, branches postical and mostly flagelliform, leaves distant below, crowded above, oblong, acutely bilobate, stipules small. Involucral bracts loosely imbricate, 3-4 lobed, mixed with smaller bracteoles. Perianth obscurely and obtusely trigonous above, mouth rather wide, six-lobed, lobes dentate.

Cephalozia heterostipa, Spruce Cephalozia p. 55. *Jungermannia inflata*, Carr. in Gott. and Rabh. Exs. No. 172. *Sarcoscyphus sphacelatus*, Hepp. in Gott. and Rab. Exs. 137.

On wet rocks in mountains.

Dioicous, depressedly cæspitose, green turning reddish or bay, or sometimes orange, fragile. Stems ¼ to 1 inch, intricate, stout, flexuous, radicellose throughout their length, simple, or dichotomous. Leaves diagonally inserted, lower distant, spreading, oblong, or cuneate-oblong, rather acutely bilobed for one-third, lobes obtuse or rounded, upper leaves approximate and more or less imbricate, chiefly about the female flowers and forks of the stem deeper coloured, broader, cuneate, bilobed one-half, or sometimes 3 - 4 lobed, obtusely toothed; cells 4 - 6 angled. Stipules small or minute, now and then obsolete, coloured, linear or subulate, entire, rarely bifid, segments

erect and narrow, sometimes with the normal form are others as long as the leaves and falcate or ligulate. Female flowers terminal on the stem, pistillidia ten to sixteen, bracts loosely imbricate, concave, broader than long, 3-4 lobed, bracteoles smaller, obliquely ovate lanceolate, entire or bilobate. Perianth emersed, green, pear-shaped, rather compressed, obscurely trigonous, mouth shortly six-lobed, the lobes dentate, teeth of equal size.—(*Plate 3, fig. 67.*)

SUB-GENUS. **ODONTOCHISMA,** *Spruce.*

Cephalozia sphagni, *Dicks.*

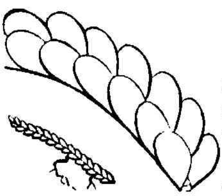
Stem serpentine; leaves erect, orbiculate, entire; perichætial leaves oblong, two-lobed, stipules lanceolate, none on sterile stems, on fertile or gemmæ bearing stems ovate.

Jungermannia sphagni, Dicks. Crypt. I., p. 6, t. 1, f. 10; Eng. Bot. t. 2470; Hook. Br. Jung. No. 33. *Sphagnocœtis communis,* Nees Syn. Hep. p. 148; Cooke Hep. f. 104, 105. *Odontochisma sphagni,* Dumort. Rev. Jung. 19; Carr. and Pears. Exs. No. 181. *Cephalozia sphagni,* Spruce Hep. Amaz. p. 400.

Marshy places amongst *Sphagnum.*

Growing in loose patches, or straggling. Stems 2 to 4 inches, procumbent, filiform, flexuous, simple, or with short innovations, radicles numerous, combined with thicker and larger opaque rootlets

2 to 3 inches long. Leaves in two rows, alternate, close together and overlapping, erect or spreading, rarely horizontal, orbicular, concave on the upper side, colour yellow brown or pale green (figs. 78, 79). Stipules on the gemmiferous shoots, oblong, or strap-shaped, obtuse, entire, near the extremity of the shoots emarginate. Perichætial leaves, uppermost, the largest, oblong ovate, cut into five or six toothed segments, the receding ones smaller and less divided, at length nearly entire, and rounded. Calyx oblong, attenuated each way, semi-pellucid, slightly plicate, mouth contracted and a little toothed. Gemmæ abundant in October and November.



78. 79.

Cephalozia denudata, *Nees.*

Stem procumbent, branched, flagelliferous branches ascending; leaves subvertical, connivent above, orbiculate, entire, decurrent about the apex; stipules numerous.

Jungermannia denudata Nees. in Mart. Erl. p. xiv. *Jungermannia scalaris β denudata*, Mart. Erl. t. 6, f. 58 b. *Odontochisma denudata*, Dumort. Rev. Jung. p. 19; Carr. and Pears. Exs. No. 69, 182, 183. *Jungermannia sphagni*, Hook. Br. Jung. Supp. t. 2. *Cephalozia sphagni*, Spruce Hep. Amaz. p. 402.

On trunks.

Similar to *C. Sphagni*, but smaller, reddish or verging on purple or violet. Stem rather short, prostrate, intricately branched, flagelliferous, attached by villose radicles, branches ascending, naked at the base, leaves increasing in size to the middle, then diminishing to the apex. Leaves almost of the same form as in *C. Sphagni*, broadly ovate or rounded ovate, oblique, obscurely decurrent, subconcave. Stipules on the stem minute, ovate, and scale-like; larger above, rounded oval.

Flowers dioicous, bracts of female flowers equal to the median leaves, apex recurved, bifid, entire or toothed. Perianth three times longer than the leaves, narrowly fusiform, three-cornered, connivent at the apex, shortly fimbriate, at length dehiscing irregularly.—(*Plate 6, fig. 74.*)

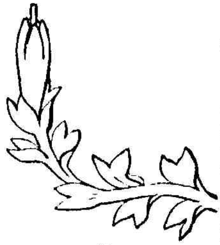
SUB-GENUS. CEPHALOZIELLA, *Spruce.*

Cephalozia divaricata, *Sm.*

Stems creeping, fertile shortened; leaves complicate, concave, somewhat rounded, semibifid, laciniæ divergent; stipules lanceolate awl-shaped, bifid; perianth cylindrical, truncate, plicate.

Jungermannia divaricata, Eng. Bot. t. 719 and t. 2463; Spruce Trans. Bot. Soc. Edin. III., 207. *Jungermannia Starkii*, Nees Eur. Leb. II., 223; Gott. and Rabh. Exs. 107, 306,

356; Cooke Hep. f. 93. *Cephalozia divaricata*, Dumort. Hep. Eur. p. 89; Carr. and Pears. Exs. No. 261.



80.

On the ground, stones, and decayed wood.

Spruce is strongly of opinion that this variable species should include several forms which many authors have regarded as distinct species, but which he resolves at most into varieties. These will be disposed as follows :—

var. α *normalis*, Spruce Ceph. p. 64. Leaves orbate, lobes of the leaves triangular.

Jungermannia byssacea, Roth. Germ. III., 387; Hook. Br. Jung. No. 12; Mack. Hib. II., 60; Mart. Erl. 166, t. 5, f. 47. *Jungermannia divaricata*, Nees Eur. Leb. II., 241; Gott. and Rabh. Exs. No. 59, 109. *Cephalozia byssacea*, Dumort. Rev. Jung. p. 18; Lind. Journ. Linn. Soc. XIII. 192.

On heaths, &c.—(*Fig. 80.*)

Frequently growing in dense tufts, of a dark green, sometimes almost black colour. Stem very slender, two to three lines long, somewhat stellately branched, branches often again divided, and procumbent, fertile ones ascending. Leaves remote, small, adpressed or spreading, nearly quadrate, embracing at the base, divided at the apex about

one-third by a rather obtuse sinus, segments acute, occasionally a little spreading, rigid and brittle when dry. Perichætial leaves numerous, imbricate, subquadrate, the exterior divided by an obtuse sinus into two equal acute segments, the interior cut into three to five unequal segments, paler. Calyx oblong, plicate, mouth not contracted, obtusely toothed. Calyptra ovate, delicate and pellucid. Capsule deep red brown, longitudinally and transversely furrowed. Elaters bispiral.

var. β *Starkii*, Spruce Ceph. p. 64. Stipules present, lobes of the leaves more ovate, or ovate lanceolate, subacuminate, acute or obtuse.

Jungermannia Starkii, Funck. G. L. and N. Syn. p. 134. *Jungermannia Grimsulana*, Jack. Gott. and Rab. Exs.

sub-var. *stellulifera*, Tayl. MSS. Leaves recurved, spreading, involucral more crowded, stellately squarrose.

Jungermannia Starkii var. *procerior*, G. L. and N. Syn. Hep. p. 134. *Jungermannia stellulifera*, Carr. and Pears. Exs. No. 32.

Dioicous, small, colour variable, greenish olive, sometimes tinged with rose, rarely whitish or almost black, densely cæspitose, or loosely creeping amongst mosses, prostrate or nearly erect; stem stout, sparingly branched, with radicles but without flagella. Leaves small, scarce, longer than the diameter of the stem, distant on the sterile, subimbricate on the fertile, rather succubous or

almost transverse, wedge-shaped or rounded quadrate, bifid half way, lobes complicate or divergent, triangular, acute, rarely obtuse, entire or rarely with a tooth, cells minute, subquadrate. Stipules none, or here and there or everywhere present, lanceolate or ligulate, sometimes bifid, rarely trifid. Female flowers terminal on the stem and long branches. Bracts trijugous, in three rows larger than leaves, more or less connate, bilobate, lobes acute and denticulate. Bracteoles scarcely smaller, intermixed. Perianth linear, or narrowly fusiform, emersed, whitish at the apex, rarely three often four, five, or six angled, mouth constricted and toothed, or nearly entire. Andræcium variedly placed on stem or branches, antheridia solitary.

Cephalozia æraria, *Pears.*

Minute, tawny or pallid, cæspitose, stems sparingly branched; leaves distant, rather squarrose, wedge-shaped, keeled, and deeply bilobate; stipules variable. Inflorescence dioicous, female branches very short, bracts twice as long as the leaves, bilobate and toothed.

Cephalozia æraria Pears., Carr. and Pears. Exs. No. 179; Spruce Cephalozia p. 96. *Jungermannia Starkii,* Carr. and Pears. Exs. No. 33.

At the mouth of an old copper mine.

Dioicous, cladocarpous, minute, tawny or pallid bay, densely depressedly cæspitose. Stems ¼ inch,

flexuous, interwoven with thick radicles, sparingly branched. Leaves distant, squarrosely patent, minute, rather wedge-shaped, obscurely keeled, deeply (to three-quarters) bilobed, entire, sinus acute or obtuse, rectangular, lobes ovate or lanceolate, subacuminate, twice as long as broad, often incurved, apiculate ; cells minute, oblong, pellucid, walls thickened at the angles. Stipules variable, the lower minute or obsolete, the upper half as long as the leaves and lanceolate, now and then connate with a neighbouring leaf, then trilobate, the highest rarely bilobed, and scarcely smaller than the leaves. Female branches very short, bracts trijugous, twice as long as the leaves, bilobed half way, sparingly spinulosely toothed, lobes ovate, acuminate.—(*Plate 2, fig. 24.*)

Cephalozia leucantha, *Spruce.*

Stems prostrate, flexuous, rather branched. Leaves small, very distant, oblong or subquadrate, bifid half way, lobes unequal, subulate, parallel or connivent. Stipules none. Perianth large, much exserted, three (rarely four) angled above, mouth minute ; capsule large.

Jungermannia catenulata, Gott. and Rabh. Exs. No. 433. *Cephalozia leucantha*, Spruce on Cephalozia, p. 68.

On decaying trunks.—(*Plate 2, fig. 26.*)

Dioicous, almost always cladocarpous, growing whitish, of the same size as *C. divaricata.* Stems prostrate, males with female closely interwoven,

thin, elongated, flexuous, rather branched and radicellose, flagella none. Leaves small, very distant, spreading or assurgent, oblong or rounded-quadrate, bifid half way or more, sinus acute or obtuse, lobes often unequal, broadly subulate, acute or rather acuminate, parallel or connivent, cells minute, subquadrate, the lower a little elongated. Stipules none. Bracts of female flowers, the innermost three to four times larger than the leaves, more or less connate, *orbicular, subdenticulate, 2-3 lobed, the lobes short,* acuminate. Perianth large for the size of the plant, *ten times longer than the leaves,* ovate-lanceolate, fusiform or rather linear, whitish, three (rarely four) angled above, mouth *minute,* and obsoletely setulose. Calyptra thin. Capsule large, often half the length of the perianth, oblong cylindrical, bay brown. Andræcia short, scarce ever occupying the whole branch, terminal or median, julaceous, bracts larger than the leaves, closely imbricate, orbicular, very concave, and keeled, two or three lobed, one-third down monandrous, bracteoles minute, linear subulate.

Cephalozia elachista, *Jack.*

Small, pallid, very tender, stem with rhizomatose base, sparingly branched ; leaves distant, oval, deeply and acutely bilobed, only crowded at the tips of fertile branches, stipules minute, often bifid ; inflorescence monoicous, male terminal, female branch often proliferous; perianth acutely trigonous, mouth toothed.

Jungermannia elachista, Jack. in Gott. and

Rab. Exs. 574. *Cephalozia elachista*, Spruce on Cephalozia, p. 70.

On damp rocks.—(*Plate 2, fig. 25.*)

Monoicous, cladocarpous and acrocarpous, small, pallid, very tender, prostrate, stem rising from a rhizomatose base, almost leafless, and sparingly branched. Leaves distant, only at the apices of the fertile branches somewhat imbricate, oval, deeply and acutely bilobate, lobes broadly subulate, acuminate, incurved, one or other armed with a tooth; cells small, subquadrate, pellucid. Stipules minute, often bifid, segments shortly setaceous; sometimes none. Male catkins terminal on the stem, or occupying nearly the whole branch. Bracts narrow, often denticulate, lobes acuminate, upwards secund. Female branch short or elongated, often innovantly proliferous. Bracts much larger than the leaves, nearly free, deeply bilobed, denticulate or subspinulose, lobes thinly acuminate Perianth elongated, acutely trigonous, mouth denticulate. Capsule oblong.

Cephalozia Turneri, *Hook.*

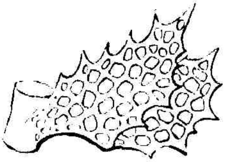
Stem creeping, branched; leaves incumbent, conduplicate, ovate, bipartite, segments spinulosely toothed; perichætial leaves everywhere imbricate, 3-4 lobed, dentate; stipules none; perianth terminal, cylindrical.

Jungermannia Turneri, Hook. Br. Jung. No. 29; Cooke Hep. f. 100; Engl. Bot. t. 2510; Mack. Hib. II., 66; *Cephalozia Turneri*, Lindb.

Linn. Journ. XIII.; Carr. and Pears. Exs. 180. *Anthelia Turneri*, Dumort. Rev. Jung. p. 18.

Banks of mountain streams. (Fr. March.)

Forming patches creeping on the ground, 1 to 2 inches diameter and radiating from a centre, pale yellowish green, stems three or four lines long, procumbent, slender, flexuous mostly simple, sometimes irregularly divided, rootlets from the under side; leaves somewhat close and regular, in two rows, spreading, embracing at the base, broadly ovate, divided half way by an acute sinus into two ovate or lanceolate sharp, almost conduplicate segments, fringed at the margins with large spine-like teeth of unequal size (fig. 81). Colour pale yellow green. Perichætial leaves closely imbricate on all sides of the calyx, differing from the cauline in being quadrate, frequently broader than long, and cleft for one-third of their length into three or four ovate acute spiny dentate erect segments. Calyx linear-oblong, slightly longitudinally plicate, or obtusely angular, at first incurved, then erect. Capsule ovate brown. Elaters bispiral.



81.

GENUS 16. ADELANTHUS, *Mitt.*

Involucre constituted from two to four opposite scale-like leaves. Perianth tubular, rather three-sided, mouth connivent, dentate,

obliquely truncate, hence split. Capsule four-valved, coriaceous, naked; elaters geminate, naked, deciduous.—*Mitt. Hook. N. Zeal.* 518. *Dum. p.* 46.

"*Adelanthus* is well distinguished by its habit of *Plagiochila*, by its decurvo-secund and usually sharply toothed leaves, and by its half inferior calyptra, strewn with sterile pistillidia, although the cladogenous perichætia, and the 3-5 angled perianth, with the third angle postical, whenever the angles are reduced to three, prove its affinity to *Cephalozia*, especially to the sub-genus *Odontochisma*."—Spruce Cephalozia, p. 17.

Adelanthus decipiens, *Hook.*, *Mitt.*

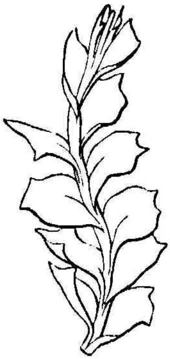
Stem flexuose, whip-like, leaves inflexed on the dorsal margin, the inferior ovate, and quite entire, superior rounded ovate, mucronate.

Jungermannia decipiens, Hook. Br. Jung. t. 50, Eng. Bot. t. 2566. *Plagiochila decipiens*, Dum. Rev. p. 15; Gott. and Rabh. Exs. 213; Cooke Hep. f. 31. *Adelanthus decipiens*, Mitt. Linn. Journ. VII., 244; Gott. and Rab. Ex. No. 474; Carr. and Pears. Exs. No. 98, 99; Spruce Hep. Amaz. p. 404.

On rocks. (Ireland.)

Growing in small dense tufts. Root large and creeping, stems erect, thread-like flexuose, ½ to 1½ inch long, simple or rarely divided at the base, sometimes two or more arise from the creeping

root. Leaves alternate, bifarious, smallest at the base and most distant, ovate and concave, margins entire, adpressed to the stem or a little spreading; the rest considerably larger, roundish or subquadrate, spreading sometimes recurved, base decurrent, margins with one or two or three large spiny teeth, irregularly placed, so that no two precisely agree (fig. 82). Flowers dioicous. Perianth longer than the cauline leaves, emerging from the involucre, obovate pear-shaped, turgid obtusely, 3 (rarely 4-5) angled, mouth at first connivent, at length rather toothed or ciliate. Calyptra pyriform, a little smaller than the perianth, enclosing twelve abortive pistillidia.



82.

GENUS 17. **HYGROBIELLA**, *Spruce*.

Stems with a rhizomatose base, fixed to the matrix by rooting flagella, without radicles. Flagelliferous branches postical, foliose lateral and axillary; leaves transverse, complicately bilobed; stipules small or none. Flowers dioicous. Perianth large, fusiform or oblong, obtusely trigonous above, with a very small mouth.—*On Cephalozia p.* 15.

Spruce, in comparing the typical species, says, *H. laxifolia* recedes from *Cephalozia* in having lateral branches, and in being (normally) quite

destitute of radicles, the stems rooting at the base by means of short naked flagella. The leaves are complicate-bilobed, and there is no capitate involucre, the uppermost leaves being alternate, and often rather remote from the perianth. Moreover, the perianths are very narrow at the mouth, and almost closed—not from being plicately constricted, as is frequent in *Cephalozia*, but from the proper shape of the constituent valves. The stem innovates repeatedly (sometimes bilaterally) from the base of successive sterile flowers.

Hygrobiella laxifolia, *Hook.*, *Dum.*

Stem lax, nearly simple, leaves quadrifarious, incumbent, lax, ovate, acutely two-lobed, perichætial twice as large, stipules none, perianth terminal, fusiform, rather plicate, mouth contracted.

Jungermannia laxifolia, Hook. Br. Jung. No. 56; Engl. Bot. t. 2677; Gott. and Rabh. Exs. No. 345; Carr. and Pears. Exs. No. 68; Cooke Hep. f. 101. *Gymnocolea laxifolia*, Dum. Rev. Jung. p. 17. *Hygrobiella laxifolia*, Spruce on Cephalozia, p. 74.

83.

Beside mountain streams. (Fr. April.)

Growing in small dense green tufts. Stems erect, thread-like, flexuous ½ inch long, slender, simple, or innovant, pale green. Leaves distant, alternate, arising on four sides, smaller towards the base,

spreading or erect and spreading, ovate, slightly keeled, cleft about one-third from the apex by an acute sinus, into two equal, sharp entire segments (fig. 83). Perichætial leaves larger than the rest, and more distantly placed, sometimes leaving the calyx exposed. Fruit terminal. Calyx large, oblong ovate, increasing in size upwards, slightly plicate, mouth contracted and toothed. Calyptra membranaceous, whitish. Capsule spherical, brown, longitudinally and transversely furrowed. Elaters bispiral.

Hygrobiella myriocarpa, *Carr.*

Branches without leaves below, cauline leaves twice as small as in *M. Stableri*, which it resembles, always bilobed half way; bracts rarely more than bijugate, quadrate, closely complicate, always free; lobes obtuse, entire; perianth quite distinct from the involucre, emersed, compressed, acutely carinate.

Diplophyllum myriocarpum Carr., in Carr. and Pears. Exs. No. 96. *Jungermannia myriocarpa* Carr., Spruce Rev. Bry., 1881, 97; Carr. Trans. Bot. Soc. Edin., Vol. XIII., p. 466, t. 18, fig. 4. *Hygrobiella myriocarpa*, Spruce Cephalozia, p. 75.

Creeping among spongy peat-like soil.—(*Plate 2, fig. 29.*)

Without stipules. Creeping at the base, rhizo-

matous shoots entangled, flexuose, polished, resembling pale brown horse-hair; stems 2-7 mm. long, ascending, terete, rigid, interrupted, repeatedly innovant, ramuli springing from one or both sides of the old axis, either barren and setaceous, or fertile, and with rapidly accrescent leaves. Leaves on the lower portion of the shoots and flagella distichous, approximate, erect, and appressed to the stem so closely as to be readily overlooked, ovate, carinate-concave, cleft for half their length into two lanceolate lobes, sinus acute, texture thin, polished, punctate-areolate, cells subquadrate; colour golden brown. Involucral leaves much larger, vertically spreading, lobes shallower and more obtuse, half hiding the perianth. Perianth at first turbinate, when mature roundish ovate, ventricose, obtusely three cornered below, mouth contracted, bicristate in front; in older specimens multi-plicate, minutely toothed.—*Carrington.*

Hygrobiella Nevicensis, *Carr.*

Shoots creeping, entangled, flagelliferous; stems ascending, simple or irregularly branched, flexuose, leafless below and devoid of rootlets. Leaves bifarious, alternate, scarce broader than stem, distant, vaginate, upper erect, roundish ovate, lower spreading, ovate quadrate, complicate, concave, rounded at base, bidentate, sinus acute, texture thin. Without stipules.

Jungermannia Nevicensis, Carr. Trans. Bot. Soc. Edin., XIII., p. 464, t. 17, f. 2; Carr. and Pears. Exs. No. 85. *Hygrobiella Nevicensis*, Spruce Cephalozia, p. 77.

On moist shelving rocks.—(*Plate 2, fig. 27.*)

Tufts cushion-like, pale green. Stems ½ to ¾ inch long, mostly simple, recurved at the summit, naked below. Leaves alternate, remote, round, and sheathing at the base, shortly bidentate, sinus narrow, lobes connivent. Texture thin, translucent, marginal cells subquadrate, others hexagonal.

The tufts resemble in size attenuate forms of *Jung. bicuspidata*, but the vertically patent conduplicate distant leaves, and absence of rootlets, on all parts, distinguish it from that and other allied forms. The colour is pale lustreless yellowish green, stolons stramineous, sometimes the foliage is tinged with brown. Fructification unknown.

GENUS 18. PLEUROCLADA, *Spruce.*

Glaucescent in colour, stem radicellose, throughout its length almost equally foliate, base not rhizomatose, and not flagelliferous, subpinnately branched, branches all lateral. Base of the cauline leaves difformed (unilobed), crowded, leaves very concave, scarcely complicate; perianth very fleshy, subfloral innovations none.—*On Cephalozia, p. 77.*

The *Jungermannia albescens* of Hooker, which,

by its truly lateral and subpinnate ramification—without a single postical branch—and by some other of its characters, including even its bluish white colour when dry, is perhaps as nearly allied to *Lepidozia reptans* and to *Anthelia* as to *Cephalozia*. I have therefore separated it as a new genus, under the name "*Pleuroclada*."—Spruce on Cephalozia, p. 14.

• **Pleuroclada albescens**, *Hook.*

Stem creeping, branched; leaves incumbent, concave, ovate, emarginate, perichætial leaves everywhere imbricate; stipules triangular; perianth terminal on lateral branches, ovate.

Jungermannia albescens, Hook. Br. Jung. No. 72, Supp. t. 4; Gott. and Rab. Exs. No. 33, 468; Cooke Hep. f. 73. *Cephalozia albescens*, Dumort. Rev. Jung. p. 18; Lindb. Journ. Linn. Soc. XIII., 192. *Pleuroclada albescens*, Spruce Cephalozia p. 14; Carr. and Pears. Hep. No. 262.

84.

On mountains.

Growing in large loose patches. Stems ½ to ¾ inch in length, creeping, waved, thread-like, branched twice or thrice dichotomously, and attached to the ground by tufts of radicles. Leaves rather distant and alternate, very small, nearly hemispherical, half-embracing at the base, at the apex cut with

an obtuse notch, with the segments rather connivent (fig. 84). Colour pale green, becoming whitish when dry. Stipules distant, one between each pair of leaves, nearly the width of the stem, ovate-lanceolate, entire. Calyx oblong, even, mouth contracted and denticulate.

Sub-tribe V. SCAPANIOIDEÆ.

Stems producing only a few lateral branches. Leaves complicately bilobed, antical lobe smaller. Perianth from the front compressed. Elaters dispiral.

GENUS 19. **SCAPANIA**, *Dumort.*

Involucre bifoliate, conforming to the other leaves. Perichætial leaves two-lobed, conduplicate. Perianth compressed on the back, apex truncate, at first decurved. Capsule four-valved, coriaceous, not cellular, nor pellucid, decussate, naked. Elaters double, naked, deciduous. *Dumort. Rev. Jung.* p. 14 (1835).

Dioicous. Perianth terminal, smooth, obovate, compressed from before backwards, from a contracted base, mouth truncate, bilabiate, entire or toothed, decurved. Involucral bracts two, free, resembling the ordinary leaves, capsule ovate, four-valved, cleft to the base. Elaters bispiral.—*Carr. Hep.* 73.

Growing in woods, on moist rocks or boggy places, in conspicuous tufts. Leaves alternate,

unequally two-lobed, inferior lobe larger. Amphigastria wanting.

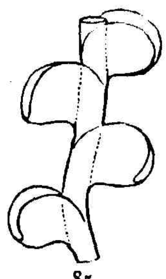
Scapania compacta, *Roth.*, *Dum.*

Stem procumbent, nearly simple, leaves nearly equally conduplicately two-lobed, lobes rounded, entire, perichætial leaves toothed. Perianth with crenulate mouth.

Jungermannia compacta, Roth. Germ. III., 375. *Jungermannia resupinata*, Hook. Br. Jung. No. 23. *Scapania compacta*, Dumort. Rev. p. 14; Gott. and Rabh. Exs. No. 143, 168, 445, 492; Carr. and Pears. Exs. No. 19; Cooke Hep. fig. 39.

On loamy and heathy soil. (Fr. May, June.)

Generally in small dense tufts. Stems ½ to ¾ inch long, simple, rarely once or twice forked, procumbent, extremities erect when fruiting. Colour reddish brown. Leaves closely imbricated towards the extremities in fertile plants, more distant in barren ones, bifarious, horizontal, roundish, divided into two nearly equal lobes, each convex on the outer surface (fig. 85), in the lower part of the plant the inferior lobe is a little the largest, all entire, except that some of the terminal ones are microscopically crenate, at the base decurrent, and half-embracing, of a yellowish brown colour. Perigonial leaves similar,



85.

more crowded. Perichætial leaves only slightly different, lobes faintly crenate. Calyx narrow at the base, cylindrical, becoming depressed, and at the extremity quite flat, incurved when young, mouth truncate, and minutely crenate. Capsule ovate, deep brown. Elaters bispiral.—(*Plate 3, fig. 32.*)

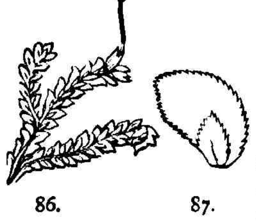
Scapania resupinata, *L., Dum.*

Stem erect, rather branched, leaves unequally conduplicately two-lobed, lobes rounded-ovate, rather obtuse, toothed. Perianth with a dentate mouth.

Jungermannia resupinata, Linn. Sp. 1599, Eng. Bot. t. 2437. *Scapania resupinata*, Dumort. Rev. Jung. p. 14; Carr. and Pears. Exs. No. 16, 17; Carr. Br. Hep., t. 8, f. 26 (partly).

On shady rocks and walls. (Fr. May, June.)

var. *β laxifolia*, Lindenb. p. 53. Stem more lax, leaves more remote, lobule less obtuse.



86. 87.

var. *γ recurvifolia*, Hook. Jung., t. xxi., f. 8. Lobes and lobules of the leaves recurved.—(*Figs.* 86, 87).

Densely cæspitose; shoots slender, of uniform diameter, radiculose, zonate, ochraceous, olive brown or olive; leaves closely imbricated, equal,

pellucid, smooth, divided for one-third of their length into two lobes ; inferior lobe roundish-obovate, obtuse or apiculate, convex, strongly reflexed ; lobule half the size, obliquely reniform, crossing the stem, apex rounded, concave, incumbent or antiflexed ; margins equally dentate ; perianth obconic, truncate, inciso-dentate ; capsule small, oval, shortly stipitate.—(*Plate 3, fig. 33*).

Scapania Bartlingii, *Nees.*

Ascending; leaves shortly conduplicate, two-lobed, concave at the base and embracing, spreading at the apex, lobes equal half-rounded, subrepand, entire; perichætial leaves broader, rounded.

Jungermannia Bartlingii, Hampe. Nees Eur. Leb. II., 423. *Scapania Bartlingii*, Nees in Syn. Hep. p. 64 ; Gott. and Rabh. Exs. No. 292 ; Carr. and Pears. Exs. No. 18 ; Carr. Brit. Hep. p. 83, t. ix., f. 27.

On damp shady rocks by streams.

Tufts depressed, scattered, of a sordid green colour, frequently creeping among other mosses and hepatics: Stems stout, pale brown, lower two-thirds creeping, upper third ascending. Leaves loosely imbricated, alternate, with an upward and forward direction, when opened out cordate, the base saccate and embracing, divided for a short distance into two nearly equal lobes, apiculate or obtuse. The base of the leaf generally vaginate and erect, the upper por-

tion spreading, texture thin. Inflorescence dioicous. Involucral bracts somewhat larger and broader, lobes obtuse. Perianth oblong, half-immersed, apex recurvate, obliquely truncate, entire. Calyptra obovate.—(*Plate 3, fig. 34.*)

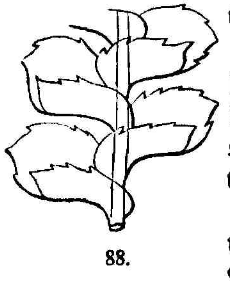
Scapania æquiloba, *Schw., Dum.*

Stem erect, leaves conduplicate, two-lobed, lobes nearly equal, rounded ovate, acute, dentate; perianth with dentate mouth.

Jungermannia æquiloba, Schwag. Prod. p. 24; Ekart. Syn. Jung., t. ii., f. 90. *Scapania æquiloba*, Dumort. Rev. Jung. p. 14; Gott. and Rabh. Exs. No. 89, 169, 331, 404, 408; Carr. and Pears. Exs. No. 159; Cooke Hep. f. 40; Carr. Br. Hep. p. 81, t. 8, f. 26 partly.

Crevices of rocks in subalpine districts.

var. α *dentata*, Gott. and Rab. Exs. 331. Leaves broader, irregularly toothed, apical teeth largest.



88.

var. β *inermis*, Gott. and Rab. Exs. 80, 404, 408. Lobes obovate, oblong, sometimes cultriform, entire.

Stems shorter, gracile, loosely tufted; leaves approximate, equi-distant; texture firm, olive brown, verrucose, divided for a short dis-

tance into two nearly equal subdentate lobes (fig. 88); inferior lobe roundish ovate from a contracted, reflexed base, shortly pointed, apiculate; lobule obliquely ovate, crossing the stem, spreading; perianth half-immersed, obovate-oblong, truncate, inciso-denticulate; capsule ovate.—*Carr.*

"The papillose leaves separate *S. æquiloba* not only from *S. resupinata*, with which it was generally confounded, but from all other *Scapaniæ.*"

* **Scapania subalpina**, *N.*, *Dum.*

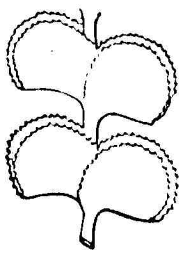
Stem erect, forked, leaves two-lobed to the middle, denticulate, lobes nearly equal, rounded, toothed, narrowly incumbent.

Jungermannia subalpina, Nees; Lind. Sp. Hep. 55. *Scapania subalpina*, Dumort. Rev. Jung. 14; Gott. and Rabh. Exs. No. 465; Carr. and Pears. Exs. 226, 227; Cooke Hep. f. 41.

In sub-alpine woods.

var. *undulifolia*, Syn. Hep. p. 65. Stem more slender, radiculose beneath, leaves broader, undulate, lobes spreading.

On rocks.



89.

Leaves denticulate towards the outside, equally distant, soft, imbricate, bifid nearly to the middle, lobes rounded, obtuse, nearly equal, closely incumbent (fig. 89). Perianth

much longer than the involucre, obovate from a narrow base, compressed, truncate, and toothed.—(*Plate 3, fig. 35.*)

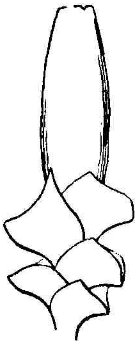
Scapania nimbosa, *Tayl.*

Stem erect, leaves ciliately dentate, two-lobed, dorsal lobule oblique-ovate, exceeding the breadth of the stem, ventral lobule oblong-ovate, spreading.

Scapania nimbosa, Tayl. Trans. Bot. Soc. Edin. II., p. 115. (Cooke Hep. fig. 46?)

Amongst moss, on mountains.

Stems growing up through tufts of moss, reddish brown, 2 to 4 inches long, loosely cæspitose, erect, somewhat branched; leaves, except at the very base, nearly of the same size, the lower lobe patent, or deflexed, and so the shoots have a squarrose appearance; their texture is of very minute cells. The lower lobe obovate, rather acute, spreading; the upper lobe smaller, obovate, nearly erect, somewhat imbricate, adpressed to the stem, the connection between the upper and lower lobes very short, margins ciliate.



90.

This was taken for *S. nemorosa* at first; but it differs in the taller size, the more deflexed lower lobes of the leaves, the slight joining between the lobes, and the more considerable and more distant ciliæ of their margins.—*Taylor.*

Scapania undulata, *L., Dum.*

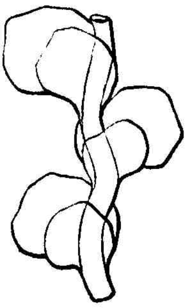
Stem erect, rather forked, leaves unequally conduplicate, two-lobed, lobes entire, rounded, anterior much the smallest. Perianth with entire mouth.

Jungermannia undulata, Linn. Sp. 1598; Hook. Br. Jung. t. 22; Engl. Bot. t. 2251. *Scapania undulata,* Dumort. Jung. p. 14; Gott. and Rabh. Exs. No. 194, 34, 90, 91, 139, 260, 278, 291, 318, 387; Carr. and Pears. Exs. 21, 22, 160; Cooke Hep. fig. 42, 43.

Wet places, among rocks. (Fr. May.)

Growing in large closely-matted tufts. Stems 1 to 3 or 4 inches, simple, or once or twice (fig. 91) divided, with nearly erect dichotomous branches, dirty green, becoming almost black. Leaves bifarious, the lower ones small and more distant; upper slightly imbricate, all spreading, decurrent, and half-embracing at the base, divided into two unequal vertical lobes (fig. 92); the lower one the largest, adpressed to the hinder part of the stem, the upper smaller by one-half, both roundish, sometimes a little pointed, slightly waved margin entire, or obscurely crenate in a few terminal ones, thin and delicate, dull green with a purplish

91.



92.

tinge, to nearly black. Perigonial leaves almost the same, more crowded and imbricate, either entire or slightly crenate. Calyx narrow at the base, attenuate and cylindrical, compressed and incurved towards the mouth, which is truncate and entire. Capsule deep brown. Elaters bispiral.

Scapania irrigua, *N.*, *Dum.*

Creeping, leaves deeply and unequally conduplicate, two-lobed, lobes rounded, somewhat mucronate, anterior twice as small, incurved at the apex, perichætial leaves bifid, lobes equal.

Jungermannia irrigua, Nees Eur. Leb. I., p. 193. *Scapania irrigua*, Dumort. Rev. Jung. p. 15; Gott. and Rab. Exs. 317, 332, 383, 392, 454, 507; Carr. and Pears. Exs. 93.

Mixed with mosses.

Stems creeping, leaves repand, rather rigid, deeply and unequally bilobate, lobes rounded and somewhat mucronate, the ventral adpressed; the dorsal twice smaller, convex, incurved at the apex. Involucral leaves bifid, lobes nearly equal, denticulate; perianth ovate, compressedly angular, mouth denticulate.—(*Plate 3, fig. 36.*)

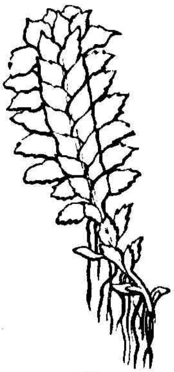
Scapania umbrosa, *Schr.*, *Dum.*

Stem somewhat erect, branched, leaves unequally conduplicate, two-lobed, lobes acute, serrate, the larger ovate, strap-shaped, the smaller ovate. Perianth with an entire mouth.

Jungermannia umbrosa, Schrad. Samm. II., p. 3; Hook. Br. Jung. No. 24 and Suppl. 3; Eng. Bot. t. 2527; Gott. and Rab. Exs. Nos. 57, 355, 412, 425; Carr. and Pears. Exs. No. 20; Cooke Hep. fig. 51. *Scapania umbrosa*, Dum. Rev. Jung. p. 15.

In mountainous districts. (Fr. April May.)

Growing in small dense patches, amongst mosses. Stem short, generally not exceeding ½ inch, erect, or ascendent, flexuous, pale reddish brown, simple, or once or twice dichotomous, with lateral innovations. Leaves bifarious, horizontal, imbricate, divided into two unequal adpressed vertical lobes, the inferior the largest, ovate, acute, recurved, and sharply serrated (fig. 93), serratures irregular and half way down from the apex. Superior lobe not so large by two-thirds, rounded-ovate, acute, exterior surface convex, apex sharply and unequally serrated. Colour pale yellow-green, sometimes inclining to brown. Texture rather firm. Perichætial leaves resembling the cauline ones, but the inferior lobes more recurved, and the superior about half their size. Calyx cylindrical at the base, or ventricose, becoming depressed and quite flat at the mouth, which is truncate and entire. Capsule brown. Elaters bispiral.—(*Plate 3, fig. 37.*)



93.

Scapania nemorosa, *L.*, *Dum.*

Stem erect, leaves unequally conduplicate, two-lobed, lobes obovate, rather obtuse, ciliately toothed, anterior doubly small, perianth with a ciliate mouth.

Jungermannia nemorosa, Linn. Sp. No. 1598; Eng. Bot. t. 607; Hook. Br. Jung. t. 21. *Scapania nemorosa*, Dumort. Rev. Jung. p. 14; Gott. and Rabh. Exs. No. 92, 224, 279, 331; Carr. and Pears. Exs. 92.

Shady banks and woods. (Fr. April, May.)

Tufts 2 or 3 inches diameter, compact, but not matted. Stems rather stout, flexuose, brownish, nearly black, naked, creeping at the base. Shoots ascending, 1 to 2 inches, simple or irregularly branched, branches spreading, recurved at the apex. Leaves rather distant, bifarious, alternate, increasing upwards, decurrent on both aspects, unequally bilobed, parallel with each surface of the stem. Lower lobe obovate, obtuse or bluntly pointed, decurrent for some distance; lobule equal to diameter of the larger lobe, cordate, acute, concave; margins of both lobes closely ciliate-dentate. Colour pale green, or yellowish green, lower leaves brownish. Inflorescence generally dioicous, rarely autoicous. Involucral bracts two. Perianth conspicuous, obovate, thinner and broader to the truncate ciliated apex. Calyptra pear-shaped, white. Capsule large, reddish brown. Elaters bispiral. Antheridia axillary, olive green. Gemmæ frequently present, at the

apices of growing stems, and terminal leaves.—(*Plate 3, fig. 38.*)

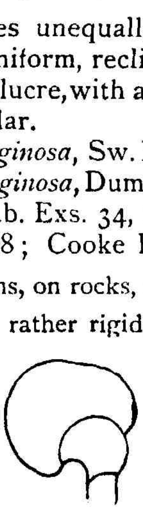
Scapania uliginosa, *Sw.*, *Dum.*

Stem erect, leaves unequally conduplicate, cordate, anterior reniform, reclinate. Perianth larger than the involucre, with an entire mouth, plicate, and triangular.

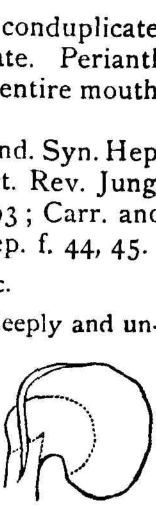
Jungermannia uliginosa, Sw. Lind. Syn. Hep. p. 59. *Scapania uliginosa*, Dumort. Rev. Jung. p. 14; Gott. and Rab. Exs. 34, 193; Carr. and Pears. Exs. 161, 228; Cooke Hep. f. 44, 45.

In sub-alpine regions, on rocks, &c.

Leaves quite entire, rather rigid, deeply and unequally bilobate, lobes rounded, ventral lobe convex, somewhat transverse, and spreading, dorsal lobe four times smaller, kidney-shaped, incumbent (figs. 94, 95). Involucral leaves similar to the cauline, with the lobes quite entire, closely pressed to the larger lobe. Perianth larger than the involucre, when young plicate, triangular. Stem sometimes floating.



94.



95.

Scapania curta, *Mart.*, *Dum.*

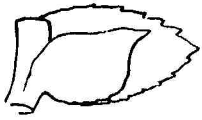
Stem ascending, leaves unequally condupli-

cate, two-lobed, lobes ovate, acute, denticulate. Perianth terminal, mouth ciliate.

Jungermannia curta, Mart. Erl. p. 148; Ekart. Syn. Jung. p. 27, t. 11, f. 89. *Scapania curta*, Dumort. Rev. Jung. p. 14; Gott. and Rab. Exs. No. 93, 393, 196, 382; Cooke Hep. fig. 52; Taylor Trans. Bot. Soc. Edin. II., p. 115.

In old woods on damp rocks.

Stems subcæspitose, shortened, ascending, the lower leaves much the smallest, rather imbricate, toothed at the apex, the lower lobe obovate, nearly plane, the upper smaller, and acute (fig 96). Lower leaves rather square. Perianth terminal, compressed, and fringed at the mouth.



96.

An extremely variable species. In Ireland it occurs in a great variety of situations, on stones on mountain sides facing the north; but its most favourite locality is in old woods on damp rocks. In some states it resembles *S. nemorosa.*

var. *β spinulosa* Nees, Gott. and Rab. Ex. 196. Shoots longer, erect, recurved at the apex; leaves yellowish green, more closely imbricated; lobes ovate, acute, distinctly spinulose-dentate; inferior lobe convex, slightly recurved; lobule obliquely ascending, half as large.

γ rosacea Corda, in Sturm II., 22, 23, t. 29. Erecto-procumbent, claret-coloured, inno-

vant, furcate; leaves approximate, narrower; inferior lobe cultriform, shortly cuspidate, plane, or slightly concave; lobule about a third as large, obliquely ovate to cuneiform, acute, ascending; margins entire, repand, or minutely denticulate.

Shoots minute, ascending, simple or innovant, fasciculate; leaves distichous, approximate, cleft for half their length into two unequal lobes; inferior lobe obliquely obovate, apiculate, nearly plane; lobule much smaller, subquadrate, acute, erectly spreading; margins entire or subdentate; perianth half-immersed, ovate, compressed, subplicate, apex truncate, inciso-dentate.—*Carrington.*

Scapania planifolia, *Hook.*, *Dum.*

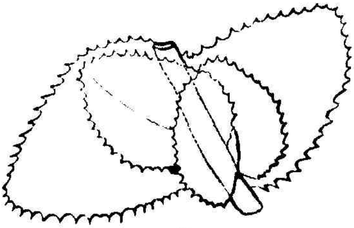
Stem erect, simple, leaves unequally two-lobed to the base, conduplicate, ciliately toothed, posterior lobe larger, ovate, anterior lobe cordate, twice shorter, perianth with entire mouth.

Jungermannia planifolia, Hook. Br. Jung. No. 67; Eng. Bot. t. 2695. *Scapania planifolia*, Dumort. Rev. Jung. p. 14; Carr. and Pears. Exs. Nos. 162, 229; Cooke Hep. fig. 50.

Moist rocky places.

Growing in closely crowded patches of a dingy

brown colour, mixed with mosses. Stems erect, 2 to 3 inches long, thread-like, flexuous, for the most part simple, now and then forked, rigid, and brittle. Leaves quadrifarious, and imbricate on both sides of the stem, those at the back



97.

the largest, plane, distichous, vertical, widely ovate. Superior leaves scarcely half so large as the rest, obliquely adpressed to them, form nearly cordate, the whole are ciliately toothed at the margins, dark brown, the texture thin and membranaceous (fig. 97).

Scapania aspera, *Müll.*

Dioicous. Stems simple, radiculose, leaves transverse, unequally bilobed, margin ciliate, epidermis minutely warted; bracts larger than upper leaves; perianth projecting, compressed, mouth truncate, ciliate.

Scapania aspera, Müll. and Bern. Cat. Hep. Sud-Ouest (188); Gott. and Rab. Exs. No. 602; Journ. Bot. Dec., 1892, t. 329.

On limestone rocks.—(*Plate 3, fig. 39.*)

Dioicous, loosely depressedly cæspitose, of a reddish or olive brown colour. Stems 2 inches long, simple or slightly branched, firm, blackish, recurved at the apex, naked at the base, radi-

culose, rootlets few, whitish. Leaves transversely inserted, somewhat smaller and more distant below, contiguous or imbricate above, subsecund, unequally bilobed, margin ciliate-dentate, postical lobe more distinctly ciliate, about twenty-five cilia round the margin, antical lobe with five to ten more distant teeth, about half the size of the postical, convex, oval, triangular, rounded, or abruptly subacute, appressed to the stem; postical lobe oval oblong, rounded or rarely abruptly subacute, reflexed; texture somewhat firm, epidermis verruculose, several minute papillæ to each cell, cells small or minute, subquadrate. Bracts rather larger than the upper leaves, lobes more equal, antical lobe rounded. Perianth projecting half beyond the bracts, obovate, compressed, mouth wide, truncate, spinosely ciliate. Male stems more slender, perigonial bracts enclosing leafy paraphyses along with the antheridia.

GENUS 20. DIPLOPHYLLUM, *Dumort.*

Involucre small-leaved, leaves conduplicate, bilobate, margin entire, conforming with the true leaves. Perianth sessile, erect, free, terete, toothed at the apex. Capsule four-valved, coriaceous, naked; elaters geminate, naked, deciduous. — *Dumort. Rev. Jung. p.* 15.

Leaves without stipules, complicate, bilobate, anterior lobe smallest.

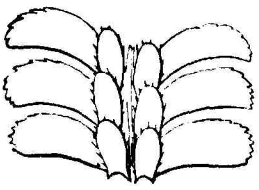
Diplophyllum albicans, *Vaill.*, *Dum.*

Stem erect, somewhat branched, leaves nearly bifarious, unequally bilobate, conduplicate; lobes rather acute, pellucidly vittate in the middle; perianth terminal, obovate.

Hepaticoides albicans, Vaill. Par. t. 19, f. 5. *Jungermannia albicans*, Linn. Sp. 1599; Hook. Br. Jung. t. 25; Eng. Bot. t. 2240; Gott. and Rabh. Exs. 13, 233, 247; Cooke Hep. f. 53. *Diplophyllum albicans*, Dum. Hep. Eur. p. 48; Carr. and Pears. Exs. No. 23, 24, 230.

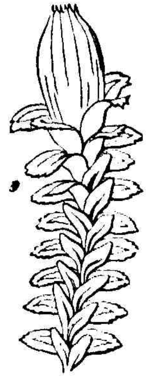
In moist woods, hedge banks. (Fr. Mar. Apr.)

Growing in large and densely-crowded tufts, 6 or 7 inches broad, or straggling amongst mosses; stems 1 to 2 inches long, erect, simple, or once or twice dichotomous, often innovant, pale yellowish brown. Leaves in two opposite rows, more or less close, the lower part embracing and decurrent, divided to within one-third of the base into two unequal vertical lobes; inferior the largest, oblong, acute, plane, a little scimitar-shaped; superior lobe about half the size, oblong ovate, acute, closely adpressed diagonally to the inner side of the larger lobe, both serrated at the point. Colour sometimes deep, more usually pale yellowish green. Perichæ-

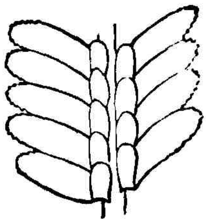


98.

tial leaves large, entirely sheathing with their base the lower part of the calyx, which latter is rather attenuated at the base, longitudinally plicate at the



99.



100.

apex, mouth contracted and toothed. Capsule reddish brown. Elaters bispiral (figs. 98, 99, 100).—(*Plate III., fig. 40.*)

Hooker's variety, *procumbens*, has a creeping habit, and grows on clay soil.

Diplophyllum taxifolium, *Wahl., Dum.*

Stem nearly erect, somewhat branched; leaves bifarious, unequally two-lobed, conduplicate, rather acute, toothed, without ribs, vittate; perianth terminal, obovate.

Jungermannia taxifolia, Wahl. Fl. Lapp. t. 25, fig. A-C. *J. albicans v. taxifolia*, G. L. and N. Syn. Hep. 76. *Diplophyllum taxifolium*,

Dum. Rev. Jung. p. 16; Carr. and Pears. Exs. 231, 232.

In mountains.—(*Plate III., fig. 41.*)

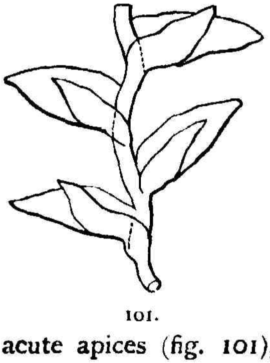
Diplophyllum Dicksoni, *Hook., Dum.*

Stem ascending, simple; leaves bifarious, unequally two-lobed, conduplicate; lobes narrowly ovate, acute, quite entire; perianth terminal, ovate, mouth scarious, somewhat ciliate.

Jungermannia Dicksoni, Hook. Br. Jung. t. 48; Eng. Bot. t. 2591; Cooke Hep. f. 55. *Diplophyllum Dicksoni*, Dum. Rev. Jung. p. 16; Carr. and Pears. Exs. No. 25.

In Scotch and Irish mountains. (Fr. Aug.)

Growing in small and densely-matted tufts. Stems ¼ to ½ inch long, thread-like, flexuous, a little procumbent at the base, the rest erect, undivided, or rarely with a simple branch or innovation. Leaves more or less close, bifarious, spreading or horizontal, frequently secund towards the apex, deeply divided into two unequal lobes or segments, the inferior twice the size of the superior, both of the same figure, narrowly ovate with acute apices (fig. 101), margins entire, or slightly



101.

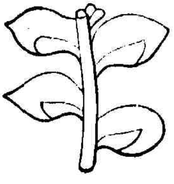
and irregularly toothed. Yellow green approaching to olive, lower leaves inclining to dirty brown. Perichætial leaves resembling the cauline, erect, and embracing the lower part of the calyx. Calyx ovate, longitudinally plicate, mouth a little contracted, and toothed. Capsule ovate, longitudinally and transversely furrowed, pale bright red. Elaters bispiral.

Diplophyllum minutum, *Dicks., Dum.*

Stem erect, dichotomous ; leaves bifarious, nearly equally two-lobed, conduplicate ; lobes entire, acute ; perianth terminal, subsphærical.

Jungermannia minuta, Dicks. Pl. Crypt. II., p. 13 ; Hook. Br. Jung. t. 44 ; Eng. Bot. t. 2231 ; Gott. and Rabh. Exs. 36, 270, 290, 429, 439, 464. Cooke Hep. fig. 83. *Diplophyllum minutum*, Dum. Rev. Jung. p. 16 ; Carr. and Pears. Exs. No. 94, 95.

Amongst mosses. (Fr. Spring and Summer.)



102.
Lower leaves.

In small loose patches, of a brownish green colour. Stems nearly erect, thread-like, flexuous, ½ to 1½ inch long. Simple, or once or twice dichotomous, with long undivided branches, with occasional innovations, brownish, brittle when dry. Leaves rather distant, more so at the base, bifarious, horizontal, subquadrate, the upper ones divided into two equal rather acute lobes, becoming more unequal and acute as they

recede downwards, so that the basal leaves have a different appearance (fig. 102, lower leaves). Colour yellow green. Perichætial leaves large, roundish, divided into two or three acute lobes or segments, paler than the cauline leaves. Calyx globose, and concealed, then obovate, a little plicate above, mouth contracted, and minutely dentate. Capsule reddish brown, striate. Elaters bispiral.—(*Plate 3, fig. 43.*)

Diplophyllum Hellerianum, *Nees.*

Stem ascending, branched, leaves bifarious, two-lobed, conduplicate; lobes acute, with a tooth at the base, perichætial leaves serrate; perianth terminal, obovate.

Jungermannia Helleriana, Nees in Lind. Syn. p. 64; Ekart. Syn. Jung. t. 12, fig. 103; Gott. and Rab. Exs. 303; Carr. and Pears. Exs. No. 164.

On trunks.

Stems creeping, intricately interwoven. Leaves complicate-concave, lower spreading, somewhat ascending, dimidiate, or bifid for a third part down, lobes equal, acute, entire or serrate; involucral leaves bifid or trifid, spinulosely-serrate; perianth ovate, contracted at the mouth. Stipules none.—(*Plate 3, fig. 42.*)

Diplophyllum obtusifolium, *Hook., Dum.*

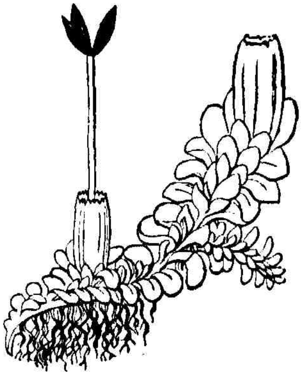
Stem ascending, simple; leaves bifarious, unequally two-lobed, conduplicate; lobes

falcate, rounded at the apex; perianth terminal, ovate.

Jungermannia obtusifolia, Hook. Br. Jung. t. 26; Eng. Bot. t. 2511; Gott. and Rab. Exs. 149, 277; Cooke Hep. f. 54. *Diplophyllum obtusifolium*, Dum. Rev. Jung. p. 16.

In mountain woods. (Fr. Mar. Apr.)

Growing in dense matted tufts, 2 or 3 inches broad, firmly attached to the soil. Stems ascending, or when crowded erect, seldom more than three or four lines long, simple, with innovations, dirty green (fig. 103). Leaves in two opposite rows, horizontal, rather closely imbricated, entirely concealing the stem, smaller at the base, somewhat rounded, divided about half way down into two unequal vertical lobes; the inferior the largest, oblong, a little curved on one side, thus scimitar-shaped; the superior ovate, or oblong-ovate,



103.

closely adpressed diagonally to the larger lobe, both obtuse at their apices, and rounded, margins entire, except in a few terminal leaves, which are microscopically crenate. Perichætial leaves larger than the rest, more erect, a little waved at the margins, enveloping the lower part of the calyx, which latter is ovate or obovate, erect, plicate in

the upper half, mouth contracted, and cut into several sharp teeth. Capsule ovate, reddish brown. Elaters bispiral.

Diplophyllum saxicolum, *Schrad.*

Stem ascending, somewhat branched, leaves unequally two-lobed, entire, posterior lobe rounded, anterior three times smaller, acuminate. Perianth obtuse, 5-6 plicate.

Jungermannia saxicola, Schrad. Samm. 97; Mart. Erl. t. 5, f. 34; Gott. and Rab. Exs. 12, 302 and *bis;* Carr. and Pears. Exs., No. 234, 235, 236; *Diplophyllum saxicolum*, Dumort. Rev. Jung., p. 16.

In sub-alpine regions.

Stipules absent; leaves deeply bifid, complicate; lobes nearly equal, broadly ovate, entire, below closely imbricate, convex, rounded, apex of the stem innovant, with the leaves semi-terete; fruit terminal on subdorsal innovations. Bracts two pairs, imbricate, a little smaller than cauline leaves, inferior pair broad, plicate, mostly trifid or subquadrifid, lobes sparingly and obtusely repand, dentate, superior ovate, acute, broadly rounded in the middle. Perianth ovate, obtuse, 5-6 plicate, with the angles between the folds rounded and obtuse, mouth laciniate.—(*Plate 3, fig. 44.*)

Sub-tribe VI. EPIGONIANTHEÆ.

Leaves succubous or transverse (never incubous). Flowers acrogenous. Perianth, when perfect, normally compressed from the side. Elaters dispirous, rarely monospirous.

GENUS 21. **LOPHOCOLEA,** *Dumort.*

Involucre small leaved, perichætial leaves multifid. Perianth sessile, erect, cylindrical, three-cornered above, mouth three-lobed, cristate. Capsule four-valved, coriaceous, naked. Elaters double, naked, deciduous. —*Dumort. Hep. Eur.* 83.

Plants stipulate, leaves subcurrent, bifarious, flattened, divided. Perianth cristate.

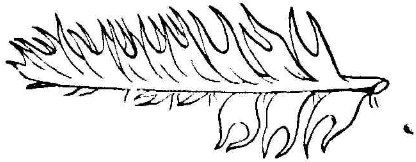
Lophocolea bidentata, *L.*

Stem procumbent, branched ; leaves accumbent, obliquely-ovate, bicuspidate, acuminate, sinus sublunate ; perichætial leaves bipartite, laciniæ acuminate, dentate. Stipules laciniate, segments linear. Perianth terminal.

Jungermannia bidentata, Linn. Sp. 1598 ; Engl. Bot. t. 606 ; Hook. Br. Jung. No. 30 ; Musc. Britt. 235. *Lophocolea Hookeriana,* Nees Eur. Leb. II., 336. *Lophocolea bidentata,* Du-

mort. Rev. Jung. p. 17; Cooke Hep. f. 109; Carr. and Pears. Exs. No. 184.

var. *β obtusata.* Leaves obtusely emarginate, dark green; stipules multifidly divided.



104.

Jungermannia bidentata β obtusata, Hook. Jung. figs. 30, 12, 13.

var. *γ gracile,* Carr. Irish Hep. t. 2, f. 6. Fronds creeping, attenuate, not larger than in *J. bicuspidata;* leaves narrower at the base, ovate, divided half way down into two slender, curved segments; stipules slender, bifid (fig. 104).

var. *alata,* Nees. Some stems bear both entire and winged perianths, so that this state is not even entitled to rank as a variety.

Plentiful in moist shady situations.—(*Plate 3, fig. 45.*)

Growing in more or less crowded patches of some inches diameter. Stems 1 to 1½ inch long, procumbent, flexuose, branched, the branches often erect, towards the extremity simple, or with a short lateral shoot. Leaves close but scarcely imbricated, in two opposite rows, plane or slightly

waved, horizontal, broadly ovate at the base, half surrounding the stem, the lower margin very decurrent, divided at the apex for one-quarter or one-eighth of their length with a more or less acute sinus, into two equal sharp straight segments, the tips of which resemble cilia. Colour light green. Perichætial leaves, the first pair are twice the length of the stem leaves, quite erect and adpressed, deeply divided into two equal lanceolate segments, which are sometimes dentate at the margin. Stipules, one to every pair of leaves, adpressed to the under side of the stem, oblong, generally divided into two, sometimes three, segments, here and there dentate. Calyx sometimes slightly incurved in an early stage, ovate-oblong, obtusely triangular, mouth slightly contracted at first, afterwards somewhat expanded, with a deep incision on one side, and bordered with numerous laciniæ. Capsule ovate, deep brown, longitudinally and transversely furrowed. Elaters bispiral.

Lophocolea cuspidata, *Limp.*

Stem procumbent, branched; branches ascending or erect; leaves acutely emarginate, bidentate; teeth elongated, acuminate; stipules quadrifid, perianth terminal, tubulose, laciniate.

Lophocolea bidentata β cuspidata, Nees in Fw. Herb. II., 327. *Lophocolea Hookeriana γ prolifera*, Nees. *Lophocolea cuspidata*, Limp. Leb. Krypt. Schl. p. 303; Carr. and Pears.

Exs. No. 185. *Jungermannia bidentata*, Raddi. Etrusc. t. IV., fig. 6.

On mountain rocks.—(*Plate 3, fig. 46.*) (Fr. April.)

Leaves with the teeth longer than in *L. bidentata*, more acute and straight. There has been some uncertainty about *L. Hookeriana*. Gottsche says that: "Hooker's figure of *L. bidentata* (t. 30, f. 7) shows a deeply divided involucral leaf, each lobe bidentate, which I have never seen in British or German examples, and which must be of rare occurrence, or depend on some mistake. Our German forms have the segments of the involucral leaves either entire, merely elongated cauline leaves, or they have a small tooth on one side, and the adjacent stipule is quadrifid." It was probably a mere local variety of *L. bidentata*, and not the above species.

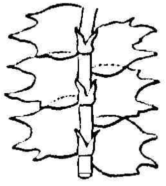
Lophocolea spicata, *Tayl.*

Stem branched ; leaves horizontal, ovate, apex two or many toothed ; perichætial leaves many toothed ; stipules free, bifid, dentate at the base, fruit terminal ; perainth prismatic, naked ; mouth torn and toothed ; perichætial leaves two-toothed, serrate.

Lophocolea spicata, Tayl., in Nees Syn. Hep. 167 ; Cooke Hep. fig. 113 ; Carr. and Pears. Exs. No. 263.

Amongst mosses.

Stem creeping, branched; leaves ovate, somewhat horizontal, diversiform, apex emarginately bidentate, or tridentate, with the middle tooth largest or multidentate (fig. 105). Stipules free, small, bifid, furnished with a small tooth sometimes about the base; fruit terminal, perianth prismatic, the angles without wings, mouth laciniate, laciniæ toothed, bracts larger, many toothed at the apex, sometimes with the dorsal margin serrate; involucral stipules ovate and bifid.



105.

Lophocolea heterophylla, *Schr.*

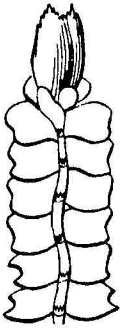
Stem ascending, branched, leaves accumbent, quadrate-rounded, entire, emarginate or obtuse; perichætial leaves external, two or three lobed, dentate; stipules dissected; perianth terminal, mouth cristate.

Jungermannia heterophylla, Schrad. Journ. Bot. 1801, p. 66; Hook. Br. Jung. No. 31; Mart. Erl. p. 140, t. 3, f. 12. *Jungermannia bicuspidata*, Eng. Bot. t. 281. *Lophocolea heterophylla*, Dumort. Rev. Jung. p. 17; Carr. and Pears. Exs. No. 36; Cooke Hep. f. 110. 112.

On trunks. (Fr. Early Spring.)

Growing in small loose patches, often amongst

moss. Stems procumbent, $\frac{1}{2}$ to $\frac{3}{4}$ inch long, flexuous, extremity with the branches erect, pale green. Leaves more or less close, in two opposite rows, horizontal, plane or slightly concave, roundish ovate, half embracing at the base, and decurrent, variable at the apex (fig. 106, after Martius). Those nearest the base acutely divided one-fifth down into two acute segments, slightly divaricate. Those in the middle obtusely emarginate, segments obtuse. Those near the apex entire and rounded. Sometimes all are nearly entire throughout. Colour, pale green. Perichætial leaves remarkably variable, in some they are entire, in others bifid, and entire, whilst others have the third pair obtusely emarginate, the second pair deeply emarginate, with acute points, and the first pair, varying with two or three acute ovate segments, unequally toothed. Stipules adpressed, oblong, bifid or trifid, segments divaricate, slightly toothed (fig. 108). Calyx obtusely triangular, mouth expanded and slit on one side. Elaters bispiral, cells compact (fig. 107).



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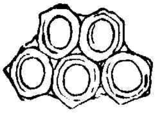


107.

108.

GENUS 22. CHILOSCYPHUS, *Dumort.*

Involucre scale-like, many-leaved, everywhere imbricate; perianth erect, cup-shaped,

terete, smooth, laterally 2-3 lobed; calyptra equal or shorter, torn at the apex; capsule four - valved, coriaceous, naked; elaters double, naked, deciduous.—*Dumort. Syll Jung.* 67 (1831); *Hep. Eur.* 100, *t.* 3, *f.* 24.

Plants with subcurrent, flattened, undivided leaves.

Chiloscyphus polyanthus, *Linn.*

Stem creeping, branched; leaves rounded-quadrate, entire and emarginate, imbricate; stipules linear, forked; perianth short, hence split; laciniæ entire; calyptra exserted.

Jungermannia polyanthus, Linn. Sp. 1597; Hook. Br. Jung., No. 62. *Marsupella polyanthos*, Dumort. Comm. p. 114. *Chiloscyphus polyanthos*, Dumort. Syll. Jung. p. 67, t. 1, f. 9; Cooke Hep. f. 106, 107.

Moist and very wet places. (Fr. Apr. May.)

The two forms of this species are:—

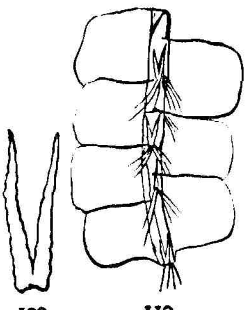
var. *β rivularis*, Nees. The most common form and the most typical.

var. *γ pallescens*, Linden. Of which Dr. Carrington writes that he sees no valid distinction between this and *C. polyanthus*.

Jungermannia pallescens, Nees Hep. Jav. p. 25. *Chiloscyphus pallescens*, Nees Hep.

Eur. p. 360. *Jungermannia polyanthus*, var. β Lindenb. Hep. Eur. 30.

Growing in loose straggling patches, easily detached. Stems procumbent, or only ascending at the tips, thread-like, flexuous, 1 to 2 inches long, simple or irregularly branched, frequently innovant. Leaves closely, and alternately in two rows, somewhat imbricate at the margins, horizontal (fig. 110), decreasing in size from the middle towards the base, as well as the extremity, nearly quadrate, angles obtuse, surface plane, or slightly convex, base decurrent at the lower margin, extremity entire in most instances, often emarginate, especially on the innovations, notch varying from obtuse to acute, pale green. Stipules narrowly lanceolate, divided nearly to the base into two entire subulate segments (fig. 109). Perichætial leaves small, ovate, obtuse, unequally serrate at the margin, a few of these resembling scales at the base of the calyx. Calyx very short, scarce half so long as the calyptra, cylindrical at the base, compressed above, widely ovate, truncate, split into two lips, each of which laciniate at the margin, clefts unequal. Calyptra oblong-ovate, white, twice as long as the calyx. Capsule ovate, brown, furrowed. Elaters bispiral.



109. 110.

Genus 23. PLAGIOCHILA, *Dumort.*

Involucre diphyllous, somewhat conforming to the leaves, but larger; leaves simple, flattened; perianth compressed at the sides, flattened, mouth oblique, truncate, dentate, or ciliate, somewhat lipped, hence split; capsule four-valved, coriaceous, decussate, naked; elaters geminate, naked, deciduous.—*Dumort. Hep. t.* 1, *f.* 11.

Leaves dimidiate, not conduplicate, nor auriculate, without a dorsal lobule.

Fructification terminal, or from the growth of innovations axillary. Autoicous or dioicous. Perianth laterally compressed, erect, or decurved at the apex; mouth obliquely truncate, bilabiate, entire, or ciliate. Involucral bracts two, erect. Pistillidia numerous. Capsule thick, four-valved. Elaters bispiral. Andræcium spiral. Perigonial leaves smaller, closely imbricate in two rows. Primary shoots leafless, creeping, with rootlets. Leaves succubous, distichous, or subsecund, dorsal margin decurrent, entire, ventral arcuate, entire, or cut. Amphigastria inconspicuous.—*Carr. Br. Hep.* '*51.*

Plagiochila asplenioides, *Vaill.*, *Dum.*

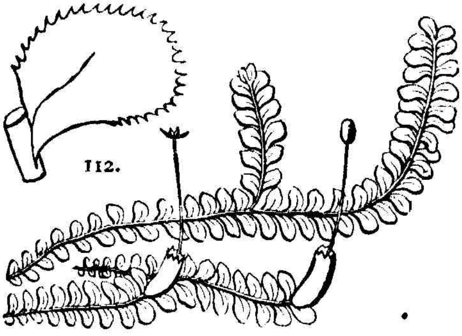
Stem ascending, branched; vertical leaves subcurrent, rounded-ovate, convex, slightly recurved, dentate; perichætial leaves revolute

at the margin; perianth terminal, oblong, mouth ciliate.

Hepatica asplenioides, Vaill. Bot. Par. p. 99. *Lichenastrum asplenii,* Dill. Musc. t. 69, f. 5, 6. *Jungermannia asplenioides,* Linn. Sp. 1597; Eng. Bot. t. 1061; Hook. Br. Jung. No. 13. *Plagiochila asplenioides,* Dum. Hep. Eur. p. 43; Gott. and Rab. Exs. 20, 271, 320; Carr. and Pears. Exs. 87; Cooke, Hep. f. 36, 37; Carr. Brit. Hep. p. 55, t. iv., fig. 12.

In moist woods, at roots of trees.

var. α *major,* Carr. Shoots 2 to 4 inches; sparingly branched, leaves loosely imbricated,



112.

111.

nearly horizontal, less rigid and convex, obovate, trapezoid, more or less closely denticulate; perianth obconic.—*Eng. Bot. t.* 1788; *Hook. Jung. t. xiii.*

var. β *minor*, Carr. and Pears. Exs. No. 88, 222. Shoots ½ to 1½ inch, summit decurved, densely cæspitose, leaves erecto-patent, approximate, subsecund, roundish; margins strongly reflexed, ciliately toothed, entire or emarginate; perianth oblong.

Form β* *humilis*, Linbenb. Shoots attenuate, leaves ovate, entire, obtuse, or notched.

Lichenastrum asplenii, Dill. Musc. t. 69, f. 6., A. B. C. *Jungermannia Dillenii*, Tayl. Trans. Bot. Soc. Edin. II., 316. *Plagiochila asplenioides β minor*, form *humilis*, Carr. Br. Hep. p. 56.

On sandy banks of streams in woods.

Tufts wide, dark green; stems about 1 inch high, sparingly branched, curved at the top. Leaves convex towards the anterior margin. Dillenius distinguished this from *P. asplenioides*. It may be recognised by the obovate leaves, which have no appearance of being truncate at the tips; by their being more crowded, nearly vertical, dentate throughout; by both their margins being recurved, and thence appearing convex in front, by their less patent position, by the greater length of their decurrent bases, very essentially by their smaller cellules; and by the mouth of the calyx having large crenulations, which are themselves denticulate. Besides the tufts are of a darker green, and the shoots more slender.—*Taylor.*

var. δ *devexa*. Carr. Br. Hep. p. 56. Shoots

compressed, subcircinate 1½ inch long, two or three times innovant-furcate; leaves secund, roundish, ciliate-dentate, closely imbricate, erect; dorsal margin straight, strongly recurved, ventral projecting backward, so as to form a crest with the opposite leaves; perianth short, oblong, scarcely exceeding the involucral leaves, and like them densely ciliate at the apex.

The typical form occurs—straggling amongst moss or forming dense tufts (fig. 111). Primary shoots creeping, leafless, entangled. Secondary less rigid, paler brown, ascending, simple or dichotomous, innovant in older plants. Leaves bifariously imbricated, alternate, horizontally patent, roundish, obovate, or trapezoid, with a broad rounded or truncate apex, dorsal margin decurrent, entire, reflexed, ventral rounded, dentate, or ciliate, superior aspect decidedly convex (fig. 112). Texture thin and semi-pellucid. Amphigastria general but distant and irregular, minute, subulate, bifid. Inflorescence normally dioicous, sometimes autoicous or with male and fertile shoots springing from the same stolon. Involucral leaves slightly larger than those of the stem. Perianth laterally com pressed, from a narrow base, curved to one side. Calyptra pear-shaped. Capsule ovate, purplish-brown, lustrous. Spores spherical. Perigonial leaves six to eight pairs, closely imbricate in two rows. Antheridia in clusters of two to four, greyish-green.

Plagiochila interrupta, *N.*, *Dum.*

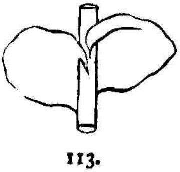
Stem horizontally branched, leaves imbricate, oval, repand, obtuse, quite entire, margin plane; perianth terminal, oblong, mouth repand, crenulate.

Jungermannia interrupta, Nees Leb. I., 165. *Plagiochila interrupta*, Dumrt. Hep. Eur. p. 44; Gott. and Rab. Exs. No. 48, 136, 516; Cooke Hep. f. 35; Carr. and Pears. Exs. No. 86; Carr. Br. Hep. p. 52, t. 3, f. 11.

In mountain woods, on dry shady rocks.

var. β *pyrenaica*, Spruce Hep. Pyr. No. 9. *Pedinophyllum pyrenaicum*, Spr. Trans. Bot. Edin. III., 200. Barren stems humifuse, serpentine-flexuous, horizontally branched; leaves ovate-oblong, obliquely truncate, two, three, or four dentate; perianth obovate, mouth acutely dentate.

Tufts broad, depressed, attached to the surface of rocks. Stems creeping, flexuous, simple or irregularly branched, olive-brown, purplish near the base, brittle when dry. Leaves elliptic, ovate, or subquadrate, distichous, alternate, horizontally imbricate; apex rounded and obtuse, retuse, or emarginate, dorsal margin scarcely decurrent (fig. 113). Amphigastria usual on the barren shoots, minute, 1-3 partite, segments subulate. Inflorescence autoicous. Fertile shoots rare.



113.

Involucral bracts two, twice the size of ordinary leaves, ovate-oblong, emarginate. Perianth obovate, compressed, mouth broad, bilabiate, curved to one side. Calyptra campanulate. Capsule dark brown. spores reddish-brown, granular, 14μ. diam. Andræcium terminal. Perigonial leaves closely imbricate, bilobate. Antheridia usually solitary.—*(Plate 3, fig. 47.)*

Plagiochila spinulosa, *Dicks.*, *Dum.*

Stem erect, rather branched, leaves semi-vertical, obovate, recurved, dentately-spinulose; perianth lateral and axillary, rounded-oblong, truncate, mouth spinulose.

Lichenastrum pinnulis alternis, Dill. Musc. p. 489, t. 79, f. 14. *Jungermannia spinulosa*, Dicks. Crypt. II., p. 14; Hook. Br. Jung. t. 14; Eng. Bot. t. 2228. *Plagiochila spinulosa*, Dum. Hep. Eur. p. 45; Gott. and Rab. Exs. 500; Cooke Hep. f. 32; Carr. and Pears. Exs. No. 89; Carr. Br. Hep. p. 60, t. iv., f. 14.

var. δ *microphylla*. Stems filiform, densely pulvinate, all the leaves minute. Carr. and Pears. Exs. No. 90.

var. ε *procumbens*, Carr. and Pears. Exs. No. 223.

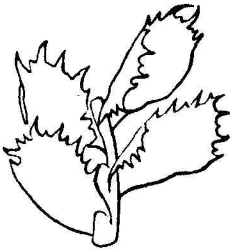
var. β *punctata*. Carr. l. c. Smaller, densely cæspitose, repeatedly ramose, ultimate branches flagelliform; leaves punctate, loosely im-

bricate, divergent, roundish-ovate, from a contracted base, apex and ventral margin spinose-dentate ; perianth axillary, obcordate, truncate, bilabiate, alæ distinctly toothed, apex densely spinulose. —*Jungermannia punctata*, Taylor Trans. Bot. Ed. I., 179.

Form * *flagellifera*, Carr. Most of the branches flagelliferous, intertwined, fastigiate, naked or microphyllous, leaves not much broader than the stems, obovate-cuneate, patent, recurvo-convex, scarcely decurrent, 2-3 dentate; amphigastria frequent.—*Plagiochila punctata*, Tayl. Lond. Jour. Bot., 1844, p. 371.

var. δ *inermis*, Carr. l. c. Closely tufted shoots slender, leaves roundish-ovate, obliquely retuse, or bidentate at the apex, margins recurved, mostly entire.

Either mixed with other hepaticæ, and mosses, or forming dense cushion-like tufts on rocks, or investing the trunks of trees. Rhizomes creeping, entangled, dirty brown. Stems upright or inclined, reddish-brown, simple or dichotomous, or innovant from the axils of terminal leaves. Shoots 1 to 4 inches, with distant or closely imbricated alternate leaves. Barren shoots nearly equal throughout. Leaves broadly ovate, or obovate,



114.

rather distant, semi-vertically spreading, dorsal margin entire, decurrent, apex 2-3 dentate, ventral margin irregularly toothed, strongly recurved (fig. 114). Amphigastria usually present, distant and irregular. Inflorescence dioicous. Perianth laterally compressed, bilabiate. Male shoots distinct, more slender. Andræcium terminal. Perigonial leaves six to twelve pairs. Antheridia oval, greyish-green in small groups.

Fructification has never been met with in this country. Dr. Carrington regards the *P. punctata*, Taylor, as the typical form. "Like most plants propagated chiefly by rhizomatous shoots or gemmæ, it exhibits great variety of aspect, and in the form and toothing of the leaves."

Plagiochila tridenticulata, *Tayl.*

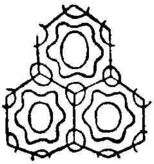
Stem nearly erect, flexuous, somewhat branched, leaves semi-vertical, accumbent, remote, wedge-shaped, 2-3 partite, recurved.

Jungermannia spinulosa β tridenticulata, Hook. Br. Jung. No. 14. *Plagiochila tridenticulata*, Dumrt. Hep. Eur. 45; Gott. and Rab. Exs. 212; Carr. Ir. Hepat. t., xi., f. 5; Cooke Hep. 3334; Carr. and Pears. Exs. No. 15.

In mountains.

Either creeping loosely amongst tufts of other

hepatics, or forming dense fasciculate patches of a dark green colour. Stems about as thick as horse-hair, purplish black, rigid, polished, but flexuous; shoots ½ to 1 inch, rarely 2 inches, long; branches alternate, divaricate, of nearly uniform size. Leaves distant, alternate, distichous, obovate, or wedge-shaped, contracted and scarcely decurrent at the base (fig. 116), bidentate at the apex, terminal leaves only are erect, dark olive or indigo-green, blackish when dry. Amphigastria generally present, minute, distant, bidentate. Andræcium spicate, ovate. Perigonial leaves three to six pairs, larger than those of the stem, closely imbricate, with many teeth. Antheridia one or two, pale olive yellow. Cells larger than in *Plagiochila spinulosa* (fig. 115).



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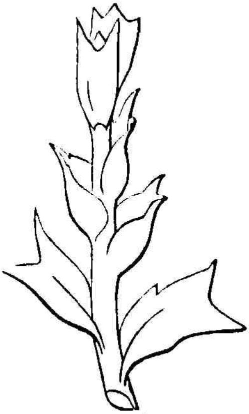


116.

"This appears to be a very distinct species. The shoots are flagelliform, nearly equal throughout, stems black and rigid, leaves distant, patent, wedge-shaped, from a narrow basis, easily detached, usually bidentate at the apex, with an obtuse sinus."

Plagiochila exigua, *Tayl.*

Stem filiform, serpentine, leaves vertical,

ovately wedge-shaped, spreading, divergent, subreflexed, plane, bifid, laciniæ rather divergent, acute.

Jungermannia exigua, Tayl. Trans. Bot. Soc. Edin. I., 179. *Plagiochila exigua*, Dum. Hep. Eur. 46; Carr. and Pears. Exs. No. 15; Carr. Br. Hep., p. 65, t. iv., fig. 13.

On trunks, parasitic on other hepatics.

Forming minute scattered, or dense tufts. About ¼ inch high, light green, usually cæspitose, but when growing amongst other species decumbent; shoots minute, naked at the base. Leaves distant, alternate, erect, then spreading, from a narrow base, wedge-shaped or obovate, bidentate at the apex, with an acute shallow sinus, lobes acute, divergent. Amphigastria generally present, minute, subulate, toothed on one side, or acutely bidentate. Taylor says it is closely allied to *P. bidenticulata*. from which it may be recognised by its smaller size, the shallower division of the leaves, their less acuminated segments, by their being shorter, by their far smaller cells, by the weak connexion of the leaves to the stems, by the paler colour of the adult plants, more spreading leaves, and by the roots occupying a greater length of stem.—(*Plate 4, fig. 48.*)

GENUS 24. APLOZIA, *Dumort.*

Involucre two or three leaved; perichætial leaves undivided, entire, conforming to the stem leaves. Perianth sessile, erect, terete,

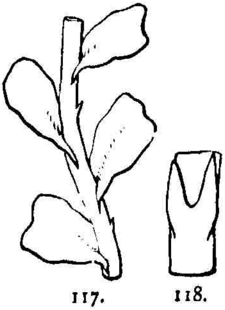
inflated, with a toothed mouth. Capsule four-valved, coriaceous, naked. Elaters double, naked, deciduous.—*Dumort. Syll. Jung.* 47 (1831), as a sub-genus.

Leaves undivided, flattened, subcurrent, or sometimes transversal. Some species stipulate, but for the most part without stipules. Perianth various at the apex.

Aplozia cuneifolia, *Hook., Dum.*

Stem creeping, leaves distant, wedge-shaped, plane, entire at the apex, or obtusely emarginate, stipules bifid.

Jungermannia cuneifolia, Hook. Br. Jung. t. 64; Eng. Bot. Suppl. t. 2700; Carr. Trans. Bot. Soc. Edin. VII., 488; Cooke Hep. 91, 92. *Aplozia cuneifolia*, Dumort. Hep. Eur. p. 55. *Coleochila cuneifolia*, Dumort. Hep. Eur. p. 106. *Leptoscyphus cuneifolius*, Mitt. Hook. Journ. III., 358.



117. 118.

Parasitic on *F. tamarisci.*

Very minute, resembling a conferva, scattered. Stems extremely slender, thread-like, scarce exceeding ½ inch, often smaller, undivided, brownish. Leaves throughout the whole plant distantly placed, spreading or erect, wedge-shaped, base decurrent, apex

entire, or cut into a wide very shallow notch (fig. 117); margin everywhere entire, dull reddish olive or brown. Stipules closely appressed to the under side of the stem, small, ovate, divided more than half way down by an acute sinus into two sharp segments (fig. 118).

Dr. Spruce believes that when the fructification has been met with this will be found to be a true species of *Clasmatocolea.*

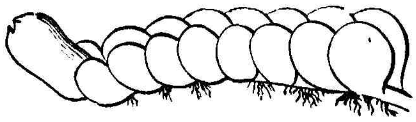
Aplozia Schraderi, *Mart., Dum.*

Stem procumbent, rather branched, leaves bifarious, erect, orbicularly elliptic, entire; perichætial leaves undulate. Stipules triangular, awl-shaped. Perianth cylindrical.

Jungermannia Schraderi, Mart. Fl. Erl. 180, t. 6, f. 55; Carr. and Pears. Exs. No. 101; Cooke Hep. f. 58. *Aplozia Schraderi,* Dum. Hep. Eur. p. 56.

In moist woods.

Collected in dense tufts, stems creeping and flexuous, radiculose, ascending, here and there branched,



119.

Leaves densely imbricate, succubous, rather orbicular, obliquely sessile at the base, or a little decur-

rent, quite entire (fig. 119). Stipules broadly subulate, in the older stems obsolete, hence sometimes described as absent.

Bracts longer than the cauline leaves. Perianth cylindrical, sometimes slightly curved, mouth shortly lacinate.

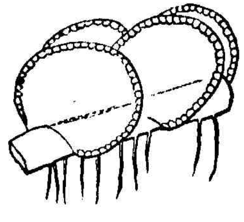
Aplozia crenulata, *Sm.*, *Dum.*

Stem creeping, branched, leaves rather remote, erect, orbicular, marginate, entire; stipules none; perianth terminal, obovate, compressed, quadrangular, mouth truncate.

Jungermannia crenulata, Sm. Eng. Bot. t. 1463; Hook. Br. Jung. No. 57; Gott. and Rab. Exs. No. 68, 172, 219, 360, 406; Carr. and Pears. Exs. No. 26; Cooke Hep. fig. 59. *Aplozia crenulata*, Dumort. Hep. Eur. p. 57.

Bogs and moist places.

Growing in densely-matted patches of considerable extent. Stems about 1 inch long, filiform, flexuous, rarely simple, mostly once or twice irregularly divided, innovant. Leaves rather distant on barren shoots, crowded and imbricated on fertile ones, erect, diminishing in size downwards, generally spreading, nearly orbicular,



120.

concave, with the margin plane, cells of the margin quadrate, forming a conspicuous border (fig. 120), colour green, dull olive, with the extremities and

terminal leaves purple. Perichætial leaves similar, closely adpressed to the calyx, the calyx obovate, laterally compressed, with four longitudinal angles, which are prominent and acute when mature, mouth contracted and irregularly toothed. Capsule ovate, shining brown, longitudinally and transversely furrowed. Elaters bispiral.

Aplozia gracillima, *Sm.*, *Dum.*

Stem creeping, fertile branches erect, leaves alternate, remote, amplexicaul, rounded ovate, concave, rounded marginate ; stipules none ; perianth terminal, cylindrical.

Jungermannia gracillima, Sm. Eng. Bot. t. 2238 ; Carr. Trans. Bot. Soc. Edin. VII., 447 ; Carr. and Pears. Exs. 248, 249 ; Cooke Hep. fig. 60. *Aplozia gracillima*, Dumort. Hep. Eur. p. 57. *Jungermannia crenulata* β, Hook. Br. Jung. p. 37. *Jungermannia Genthiana*, Hubn. Hep. Germ. 107 ; Gott. and Rab. Exs. 68, 115, 384.

On the ground.

Not nearly so small as *Lejeunia minutissima*, and differing in the stem, clasping leaves, and more essentially in its perianth, which is terminal, cylindrical, obtuse, surrounded by several imbricated leaves, which are larger than the rest, and these as well as the perianth tinged with red. Stems very slender and pellucid, branched, creeping, somewhat zig-zag, clothed with small scattered pellucid, apparently fleshy, leaves, of a roundish

121.

concave undivided figure (fig. 121), always more or less embracing the stem with their base, and destitute of any appendages.—(*Plate 4, fig. 60.*)

Dr. Carrington writes that: "Hooker describes this as not differing from *A. crenulata* except in size, but all the specimens I have examined are destitute of the conspicuous border cells, and the perianth is not compressed."

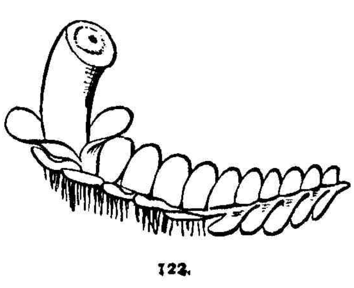
• **Aplozia lanceolata,** *L., Dum.*

Stem creeping, simple, leaves accumbent, oblong-elliptic, rounded, entire; stipules none; perianth cylindrical, arcuate, apices depressedly plane.

Jungermannia lanceolata, Linn. Sp. 1597; Hook. Br. Jung. t. 28; Carr. and Pears. Exs. No. 170. *Liochlæna lanceolata,* Nees Gott. and Rab. Exs. No. 94, 438; Cooke Hep. f. 108. *Aplozia lanceolata,* Dum. Hep. Eur. 59.

Woods and moist shady places.

Growing in small dense clusters of a pale-green colour. Stems ¼ to ½ inch long, procumbent, simple, or now and then with one or two short lateral shoots. Leaves rather close, always spreading or horizontal, entire, ovate, with a broad and half-embracing



122.

base, smaller towards the base of the stem, light yellowish green, varying to dirty brown (fig. 122). Perichætial leaves larger and more oblong than the rest, concave at the base, upper part spreading. Calyx large, a little incurved, slightly thickened upwards, the apex depressed and flattened, mouth contracted, minute, and slightly toothed.

Aplozia pumila, *With.*, *Dum.* •

Stem ascending, simple; leaves incumbent, elliptical-ovate, entire, perichætial oblong, stipules none. Perianth terminal, fusiform, plicate, mouth denticulate, compressed frontally.

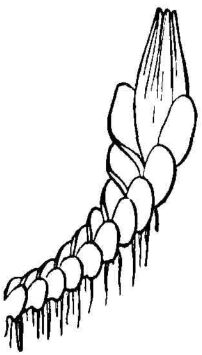
Jungermannia pumila, With. Arr. III., 866; Hook. Br. Jung. t. 17; Eng. Bot. t. 2230; Gott. and Rab. Exs. No. 244, 237, 396, 198; Carr. and Pears. Exs. No. 102; Cooke Hep. fig. 68. *Aplozia pumila*, Dum. Hep. Eur. p. 59.

On rocks. (Fr. May, June.)

var. β *nigricans*, Hook. Jung. t. 17, fig. 7-10. Stems branched, leaves more remote, turning black.

Forming small loose patches. Stems ½ inch long, wholly procumbent, or ascending at the extremity, mostly simple, though occasionally divided. Leaves rather close, varying from horizontal to erect, ovate, approaching elliptical, sometimes

nearly round; in fertile specimens the uppermost are the largest, barren ones the contrary, all of them concave, semi-embracing at the base, occasionally slightly notched at the apex (fig. 123). Texture thin and delicate, colour pale yellowish green. Perichætial leaves not differing, except that the two uppermost pairs are the largest of all, and more uniformly erect. Perianth lengthened at the base, broadest in the middle, and acuminate at the apex, where it is slightly plicate, mouth contracted, small, minutely toothed. Capsule ovate, deep brown. Elaters bispiral. The perianth is fusiform, with a minute orifice at the acute apex, obtusely biplicate above, with a narrow furrow between the folds.



123.

Aplozia cordifolia, *Hook.*, *Dum.*

Stem erect, branched, leaves incumbent, concave, cordate, entire, embracing the stem, stipules none; perianth terminal and axillary, fusiform, plicate, compressed frontally, mouth denticulate.

Jungermannia cordifolia, Hook. Br. Jung. No. 52; Eng. Bot. t. 2590; Gott. and Rab. Exs. No. 271, 341-344; Carr. and Pears. Exs. No. 27; Cooke Hep. fig. 67. *Aplozia cordifolia*, Dum. Hep. Eur. p. 59.

Highlands, in moist situations. (Fr. Aut.)

Growing in dense tufts, 1 or 2 inches across, of blackish appearance. Stems 1 or 2 to 3 inches long, flexible, erect, simple or more frequently irregularly dichotomous, branches simple, or with one or two lateral shoots. Leaves bifarious, rather distant, erect, or a little spreading, loosely imbricate, cordate, concave, margins embracing and concealing the stem (fig. 124), thin and membranaceous, dark olive, or blackish green, sometimes tinged deep purple. Perichætial leaves like the cauline ones. Perianth oblong-ovate, lengthened at the base or fusiform, slightly plicate above, mouth small and indistinctly toothed, terminal and axillary.

124.

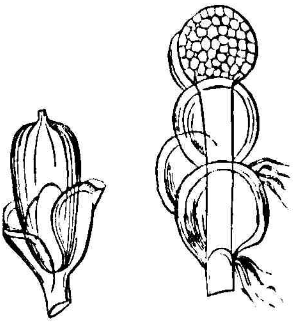
Aplozia lurida, *Dumort.*

Stem creeping, fruit-bearing, ascending, leaves incumbent, rounded, entire, superior closely imbricate; perichætial leaves very broad, stipules none. Perianth terminal, ovate, dentate.

Jungermannia scalaris, Web. and Mohr. Crypt. p. 419. *Jungermannia pumila*, Lind. Syn. Hep. 69, t. 2. *Jungermannia nana*, Nees Eur. Leb. 1317; Gott. and Rab. Exs. 287, 512; Cooke Hep. f. 63, 64. *Jungermannia lurida*, Dum. Syll. Jung. p. 50; Carr.

and Pears. Exs. No. 166. *Aplozia lurida*, Dumort. Hep. Eur. p. 60.

"Stems cæspitose, ¼ to ½ inch long, innovations arising below the apex, slender, terete. Stems ascending or erect, pale green, clothed with white radicles; branches slender; leaves round or roundish-ovate (fig. 126), erect, clasping; perianth obtuse, plicate, quadrangular (fig. 125); mouth small, four-toothed, capsule globose. Cells large, pellucid, those of the margin somewhat larger."



125. 126.

Possibly not distinct from *Aplozia sphærocarpa.*

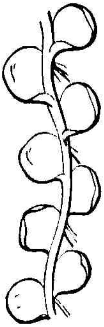
Aplozia sphærocarpa, *Hook., Dum.*

Stem ascending, simple, leaves rather remote, accumbent, orbicular, entire; stipules none, perianth terminal, cylindrically ovate, quadrifid.

Jungermannia sphærocarpa, Hook. Br. Jung. No. 74; Gott. and Rabh. Exs. No. 186; Carr. and Pears. Exs. No. 167; Cooke Hep. figs. 65, 66. *Aplozia sphærocarpa,* Dum. Hep. Eur. p. 61.

In damp places. (Fr. Early Spr.)

Growing in rather dense pale-green tufts. Stems about ½ inch long, ascending, thread-like, waved, and simple, attached by white radicles. Leaves distantly and bifariously placed, in barren shoots smallest at the base and extremity, in fertile largest towards the calyx, orbicular, a little concave and decurrent, mostly horizontal, spreading, sometimes towards the apex, erect (fig. 127), pale green. Perichætial leaves more ovate, always larger. Calyx oblong, inclining to obovate, without angles, cut at the apex into four large acute teeth (fig. 128). Capsule spherical, brown, shining. Elaters short, bispiral.



127.

128.

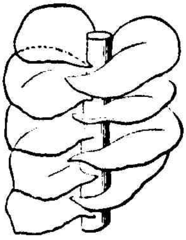
Aplozia riparia, *Tayl.*, *Dum.*

Rooting, leaves obovate, obtuse or subemarginate, perichætial saccate, spreading, squarrose. Perianth pear-shaped, plicate at the apex, compressed frontally, mouth contracted, denticulate.

Jungermannia riparia, Tayl. Trans. Bot. Soc. Edin. II., 43; Gott. and Rab. Exs. No. 428; Cooke Hep. fig. 69. *Aplozia riparia*, Dum. Hep. Eur. p. 63.

var. *minor*, Carr. and Pears. Exs. No. 168, 169.

Stems procumbent, branched. Leaves scarcely overlapping, embracing the stem at their base, roundish or oblong, concave, and *not* toothed at the margin. Calyx terminal, obovate, plaited at the apex. Leaves more distant, concave, broader and rounder than in *Aplozia pumila*, with larger cells (fig. 129). It may be distinguished from *A. pumila*, with which it was long confounded, by the paler colour, larger size, the leaves more distant, amplexicaul, more concave, broader and rounder, their cells much larger, the calyx less exserted out of the perichætium, the calyx never acuminate, and the calyx distinctly plicate above. From *Aplozia sphærocarpa* it differs by the larger and more procumbent stems, the calyx plicate above, longer and less wide, the leaves not exactly orbicular, but rather terminating in the figure of a parabola.—*Taylor.*



129.

This species varies much in the form of the perianth and leaves, the frontal compression of the perianth is slight, but perceptible.—(*Plate 4, fig. 49.*)

GENUS 25. JUNGERMANNIA, *Linn.*

Involucre small-leaved, perichætial leaves many times cut, dissimilar to stem leaves. Perianth sessile, erect, terete, inflated, mouth contracted and toothed. Calyptra free, within the perianth. Capsule four-valved, coriaceous, naked. Elaters double, naked, deciduous.—*Dumort. Hep. Eur.* 68., *t.* ii., *f.* 19.

Plants stipulate, or without stipules, leaves subcurrent, flattened, divided.

Jungermannia Bantriensis, *Hook.*

Stem nearly erect, simple, leaves rounded-ovate, lunately emarginate, two-toothed, plane, perichætial leaves similar, stipules small, lanceolate, awl-shaped, incised, dentate; perianth naked, obovate, mouth ciliate-toothed.

Jungermannia Bantriensis, Hook. Br. Jung. No. 41, note; Cooke Hep. fig. 70; Gott. and Rab. Exs. No. 305; Carr. and Pears. Exs. No. 246. *Jungermannia bidentata* var. *Bantriensis*, Hook. Br. Jung. Syn. p. 16., Suppl. t. 3.

var. *major*, Carr. and Pears. Exs. No. 105.

Plants forming dense tufts or patches; in habit much resembling *J. cordifolia*. Stems mostly erect, flexuose, simple, or sparingly dichotomous, with suberect branches, sometimes more procumbent, with divaricate branches. Leaves secund, far rounder in outline, and attached by a narrower base than in *J. bidentata*, gradually increasing in size from base to summit of stem, terminal ones three times the size of the lowest, all emarginate, or more rarely tridentate, with obtuse, acute, or apiculate segments; the lower with a lunulate sinus, and entire margin; the upper subacutely and often irregularly emarginate, angular or toothed at the margins. Colour varies from yellowish green to deep olive, never whitish. Leaves of branches and innovations narrower, more deeply

and acutely cloven than the rest; on procumbent stems seldom secund, but merely incurved or even spreading. Stipules minute, seldom broader than the stem, variable, usually lanceolate-awl-shaped, with one or more lateral teeth, sometimes entire, rarely bifid, never *twisted*. Inflorescence dioicous. Male plants in separate tufts, stems antheriferous in their upper half; perigonial leaves acutely divided above into three incurved unequal teeth, each leaf enclosing one to four anthers. Female flowers terminal, without proper perichætium. The calyces, which contain only pistilla, are pear-shaped, but, when full grown, nearly cylindrical, depressed above, and terminating in a narrow tubular, ciliated mouth; destitute of furrows or folds, the transverse section always circular. Calyptra obovate, narrower than the calyx, and perfectly free. Peduncle thicker than in *J. bidentata*. Capsule smaller, more spherical, the valves of a deep purplish brown hue. Seeds slightly smaller, and spiral filaments shorter.

The fructification of *J. scutata* differs, in that it is lateral, with a perichætium of two to six leaves, entire, or variously cut at the extremity, and far smaller than the stem leaves, and the calyx is obovate with a trigonous toothed mouth. The calyptra is of equal width with the calyx, and adheres to its sides. —*Spruce*. (*Plate 4, fig. 50.*)

Jungermannia Kunzeana, *Huben.*

Stem ascending, rooting without flagelli; leaves bifarious, spreading, acutely emarginate, bilobed, lobes erect, obtuse, incurved; stipules bipartite, awl-shaped, entire.

Jungermannia Kunzeana, Hubn. Hep. Germ. p. 115; Tayl. Hook. Journ. 1845, 278; Dum. Hep. Eur. 69; Carr. and Pears. Exs. No. 237, 238. *Jungermannia plicata*, Hartm. Fl. Scan. II., p. 90; Gott. and Rab. Exs. 394.

On sub-alpine moors.

Growing in dense olive-brown patches. Stems about 1 inch long, erect, or ascending, simple or dichotomous, attached from the under side by hair-like radicles; leaves almost vertical, crossing the stem, spreading, roundish, quite entire, all pointing upwards, obtuse, complicate, bifid with a narrow sinus, some near the top trifid, the laciniæ obtuse, incurved, reticulate with large areolæ; stipules bipartite, rather rigid, spreading, entire, of the same texture as the leaves; laciniæ lanceolate, divergent, with a few spinous teeth at the base, sometimes one or two above the base. Lateral perichætial leaves quadrifid. Perianth convex above, deeply channelled below, peduncle four times as long as the perianth. Capsule oblong-ovate.—(*Plate 4, fig. 59.*)

Jungermannia Muelleri, *Nees.*

Stem ascending, rather branched; leaves imbricate, plane, obliquely ovate, emarginate, bidentate; laciniæ straight, acute; perichætial leaves ciliately toothed; stipules two or tri fid, rather ciliate at the base; perianth cylindrical, mouth rostrate.

Jungermannia Muelleri, Nees in Lind. Syn. p. 39; Gott. and Rab. Exs. No. 58, 147, 148, 154, 227, 395. *Jungermannia bantriensis*, var. *Muelleri*, Carr. and Pears. Exs. No. 247.

On stones, limestone rocks, and amongst moss.

Stem creeping, ascending at the apex, flexuous, innovant; leaves semi-vertical, orbicular, repand, emarginate, bidentate, with a narrow sinus; laciniæ unequal, acute or obtuse; involucral leaves larger, spreading at the apex, bifid, embracing at the base, more or less ciliate, dentate. Stipules lanceolate, bifid or trifid, or pinnately ciliate, subulate at the tips. Perianth subcylindrical, even, mouth plicate, rather mucronate.—(*Plate 4, fig. 5.*)

Jungermannia attenuata, *Lind.*

Stem ascending, nearly simple; lower leaves accumbent, subquadrate, emarginate-trifid; upper leaves incumbent, rounded, tri-crenate, concave; perichætial leaves subtrifid; stipules ovate, entire; perianth cylindrical, terminal.

Jungermannia barbata β minor, Hook. Br. Jung. t. 70, f. 18-22. *Jungermannia attenuata*, Lind. Syn. Hep. 48; Carr. and Pears. Exs. No. 74.

On the ground, rocks or trunks.

Stem ascending, with a few radicles, fasciculately

innovant about the apex, innovations subcylindrical, primary leaves semi-vertical, oblique, spreading, roundish, for the most part concave, two or four toothed, teeth acute, nearly equal, inflexed when dry, on the innovations closely imbricate, ovate, nearly quadrate, irregularly two to four toothed; stipules none, or subovate, bifid, segments entire, involucral leaves two, tridentate, spreading. Perianth terminal, oblong, plicate at the apex.—(*Plate 4, fig. 52.*)

Jungermannia barbata, *Schr.*

Stem ascending, branched; leaves subquadrate, 3-5-fid; perichætial leaves similar; stipules bipartite, laciniate; perianth oval, terminal.

Jungermannia barbata, Schreb. Spic. 107; Hook. Br. Jung. No. 70; Cooke Hep. f. *87, 88; Carr. and Pears. Exs. No. 244. Jungermannia quinquedentata*, Huds. Angl. p. 511; Engl. Bot. t. 2517.

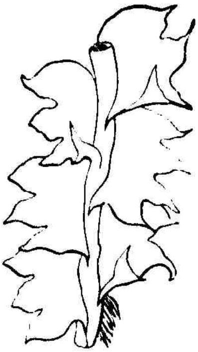
var. β *Flœrkii*, W. and M. Mart. Erl. p. 144, t. 4, f. 17; Carr. and Pears. Exs. 106, *a. b.* Leaves connivent; laciniæ of the stipules awl-shaped, very long.

var. α *quinquedentata*, Nees Eur. II., p. 196; Carr. and Pears. Exs. No. 107. Leaves with the teeth rather obtuse; stipules minute.

In woods and heathy places. (Fr. April.)

Growing in more or less densely-crowded patches,

of unequal size. Stems 1 to 2 or 3 inches long, not really branched but innovant, filiform, greenish. Leaves variable in closeness, sometimes densely imbricate, at others distant, distichous, alternate, spreading, or erect, subquadrate, slightly decurrent at the base, divided at the apex into three, sometimes two, often four, large triangular teeth (fig. 130), not always equal; the inferior one usually smallest, frequently incurved, or conduplicate, the rest expanded, entire, mostly acute at the apex, sometimes acuminate, or spinose. Besides these large teeth, a very minute one at the base of the upper margin of the leaf near its insertion. Usually pale or bluish green. Stipules one to each pair of leaves, variable in size. Widely lanceolate, divided three-fourths down into two narrow acuminate segments, again cut at the margin into teeth or laciniæ (fig. 131). Perigonial leaves crowded, scarcely different from the cauline ones, but more convex, with a swollen or ventricose base. Perichætial leaves three or four, round the base of the calyx, rather roundish, concave in the inside, quadrifid at the apex, segments very sharp, with a small spiny tooth on one side. Calyx nearly spherical, then obovate, plicate above, mouth contracted, sharply irregularly toothed. Capsule dark brown. Elaters bispiral.



130.

131.

Jungermannia lycopodioides, *Wallr.*

Stems prostrate, rooting; leaves divergent, suborbicular, margin repand, five-toothed, teeth nearly equal, plane, rather obtuse; stipules thick, lanceolately bifid, margin ciliate.

Jungermannia lycopodioides, Wallr. Crypt. Germ. III., 76; Carr. and Pears. Exs. No. 243. *Jungermannia barbata* var. *lycopodioides*, G. L. and N. Syn. p. 125.

On clay soil and amongst moss.

Stem prostrate, rooting, nearly straight and rigid, with a few furcate innovations; leaves semi-vertical, imbricate, plane, divergent, broadly embracing the stem, transversely orbicular, pallid green, soft, lobately 3-5 dentate, lobes nearly equal, rounded, mucronate, reclined upwards; involucral leaves ventricose, embracing, 4-5 dentate, teeth acuminate. Stipules close, sub-imbricate, bipartite or bifid, and the acuminate laciniæ often to the middle ciliately dentate. Perianth terminal, or by innovations subdorsal, oval, plicate.—(*Plate 4, fig. 58.*)

Dr. Carrington seems to think that *J. Lyoni* should be referred as a variety to this species.

** *Stipules none.*

Jungermannia Lyoni, *Tayl.*

Stems ascending, rather branched; leaves

subquadrate, recurved, trifid; perichætial leaves rather long; perianth lateral, ovate, plicate; stipules none; fruit at length lateral.

Jungermannia Lyoni, Tayl. Trans. Bot. Soc. Edin. I., p. 116, t. 7; Spruce Trans. Bot. Edin. III., 204; Carr. and Pears. Exs. No. 31.

Amongst moss.—(*Plate 4, fig. 53.*)

Stems 2 or 3 inches long, erect, or ascending, with entangled short, flat, simple, pale yellowish roots, along the inferior side. Colour of stems dark chestnut brown when dry, paler above when wet. Leaves pale brownish yellow, with a slight greenish hue when moist, rounded quadrate, half embracing, concave at the base, divided at the outer side into three (rarely four) laciniæ, middle tooth usually smallest. Perichætium of two leaves, the lower quadrifid, the upper five or six fid, both recurved; calyx swollen and smooth, cylindrically obovate, about five plaits at the top, mouth shortly ciliate. Capsule oblong-rounded, pedicel short. Easily distinguished from *J. barbata* by the absence of stipules, more oblong calyx, less concave leaves, which are less imbricated, and subsquarrose. It differs from *J. incisa* by its greater size and ascending stems, by the leaves being rounded anteriorly, and having the lower laciniæ reflexed, by the more tumid and less plicate calyx, by the squarrose perichætial leaves, by the greater distance between the leaves, and their paler colour.—*Taylor.*

Jungermannia socia, Nees in Syn. p. 111, appears in British lists apparently on

account of *Jungermannia Lyoni*, Tayl., having been referred to it in the synopsis, whilst Dr. Carrington regards Taylor's species as a form of *Jungermannia lycopodioides*. We have been unable to trace the typical *Jungermannia socia* as British.

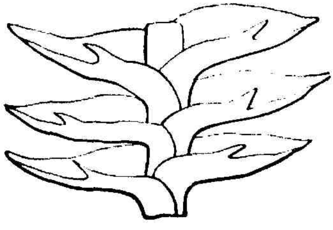
Jungermannia exsecta, *Schmid.*

Stem nearly erect; leaves bifarious, spreading, concave, acute, margin one-toothed emarginate; perichætial leaves four-fid; stipules none; perianth terminal, plicate.

Jungermannia exsecta, Schmid. Ic. 244, t. 62, f. 2; Hook. Br. Jung., No. 14, Suppl. t. 1; Gott. and Rabh. Exs. 130, 177, 358; Carr. and Pears. Exs. No. 108, Cooke Hep. f. 85.

On boggy heaths.

Forming small scattered patches, somewhat stellately disposed, pale yellowish green. Stems prostrate, ¼ inch long, fragile, simple, or rarely with a small shoot at the base. Leaves imbricated in two opposite rows, spreading or horizontal, gradually becoming smaller towards the base, where they closely surround and



132.

embrace the stem, ovate in figure, concave, or conduplicate, very acute at the apex, furnished in the middle of the upper margin with a strong sharp tooth, pointing a little upwards (fig. 132). Fruit terminal. Calyx oblong-ovate, cut at the mouth into four obtuse teeth. Capsule ovate. Elaters bispiral.

Gemmæ abundant in December and January, of a deep orange colour.

Jungermannia alpestris, *Schl.*

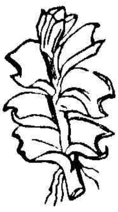
Stems creeping, nearly simple; leaves accumbent, ovate, subquadrate, obliquely two-toothed; laciniæ acute; perichætial leaves bi- or tri-fid, erect, entire; stipules none; perianth oblong, terete; mouth obtusely plicate.

Jungermannia alpestris, Schl. Exs. ii., 59; Gott. and Rabh. Exs. 190, 264, 265, 304, 304*b*; Carr. and Pears. Exs. 109; Cooke Hep. fig. 78.

Densely cæspitose in Alpine regions.

var. *gelida,* Tayl. Hook. Journ. IV., 1845, p. 277; Carr. and Pears. Exs. No. 110. Stem ascending, 1 inch long, flexuous, apex innovant; leaves approximate, erect, spreading, secund, subrotund, bifid; lobes unequal, rather acute, incurved, entire.

Jungermannia gelida, Tayl. Journ. Bot. 1845, p. 277.



133.

Stems interwoven, creeping, ascending at the apex, flexuous, bifidly-branched, and rather rigid; leaves semi-vertical, secund, ovate, approaching quadrate, oblique, with a broad obtuse sinus, obliquely bidentate (fig. 133); laciniæ unequal, acute, or mucronate, distant, very much inflected in drying; stipules none; involucral leaves broader, erect, bifid or trifid. Perianth twice as long as the involucre, oblong, even, mouth obtuse, complicate, capsule oval. Male inflorescence spicate, involucral leaves saccate at the base, bidentate at the apex.

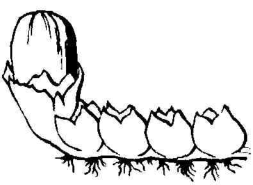
Jungermannia intermedia, *Lind.*

Stem ascending, rather branched; leaves bifarious, erect, suborbicular, acutely two-lobed, segments acute; perichætial leaves 3-5 lobed, incised, dentate, adpressed, connate at the base; stipules none; perianth terminal, obovate.

Jungermannia excisa v. *crispa*, Hook. Br. Jung., p. 11, Sup. 2. *Jungermannia intermedia*, Lind. Syn. Hep. p. 83; Gott. and Rab. Exs. 60, 144, 312; Carr. and Pears. Exs. No. 30; Cooke Hep. fig 81.

Stems creeping, simple or rather branched, the

short branches thickened at the apex, leaves semi-vertical, closely imbricate, rather concave, quadrate or roundish, loose, reticulate, the lower lunately, the upper deeply and obtusely emarginate, bi- or tri-fid, laciniæ unequal and acute (fig. 134). Bracts trifid or quadrifid, rather serrate, connate at the base, thus ternate or quaternate.



134.

Perianth short, ovate-triangular, plicate, mouth denticulate. Stipules absent.

Jungermannia capitata, *Hooke.*

Stem prostrate, simple; leaves erect, rounded-quadrate, lower bifid, the rest and perichætial leaves 3-4-fid; stipules none; perianth terminal, ovate.

Jungermannia capitata, Hook. Br. Jung., t. 80; Carr. and Pears. Exs. No. 242 (variety).

On turfy soil.

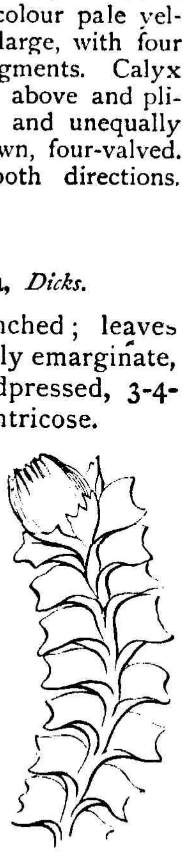
Growing in small pale-green patches, stems ¼, rarely ½, inch long, almost always simple, greenish, with numerous pellucid radicles. Leaves rather closely ranged in two rows, sometimes spreading or nearly horizontal, generally nearly erect, roundish, approaching quadrate, those at the base smallest and bifid, the rest increasing in size upwards, and trifid or quadrifid, segments unequal, a little waved and acute. At the very

apex, particularly of the sterile shoots, the leaves are collected in a head or cluster, colour pale yellowish green. Perichætial leaves large, with four or five very unequal, incurved segments. Calyx oblong-ovate, greenish, diaphanous above and plicate, mouth somewhat contracted, and unequally toothed. Capsule ovate, dark brown, four-valved. Elaters bispiral, attenuated in both directions. —(*Plate 4, fig. 54.*)

Jungermannia ventricosa, *Dicks.*

Stem ascending, rather branched; leaves accumbent, subquadrate, obtusely emarginate, concave; perichætial leaves adpressed, 3-4-fid; stipules none; perianth ventricose.

Jungermannia ventricosa, Dicks. Crypt. II., p. 14. Hook. Br. Jung., t. 28; Gott. and Rab. Exs. 184, 185.; Carr. and Pears. Exs. No. 171; Cooke Hep. f. 77.



135.

In woods. (Fr. Spring.)

Sometimes growing in dense patches, at others scattered amongst *Sphagnum*. Stems ½ to ¾ inch long, procumbent, rarely simple, more frequently once or twice branched, the branches bearing innovations. Leaves rather close, but scarcely imbricate, in two opposite rows, spreading, with the lateral margin

more or less incurved, subquadrate, widely and obtusely notched at the apex, with the points acute, and sometimes involute (fig. 135); the lower ones cleft into three, or more rarely four, teeth, which are frequently unequal. Perichætial leaves closely embracing the calyx, cut at their apex into three, four, or five acute, unequal teeth. Fruit terminal. Calyx at first spherical, and afterwards oblong-ovate, plicate towards the apex, mouth contracted and minutely toothed. Capsule deep brown, furrowed; elaters bispiral.

Dr. Gottsche says that this species may always be distinguished from its allies by the violet colour of the cortical layer of the stem.

Jungermannia porphyroleuca, *Nees.*

Stem creeping, rather rigid; leaves ovate, bifid; lobes unequal, rather obtuse; perichætial leaves multifid, attenuated at the base, subconnate; stipules none; perianth club-shaped, plicate at the apex, mouth denticulate.

Jungermannia excisa, Fl. Dau. t. 1715, f. 1; Ekart. Syn. Jung. X., f. 79. *Jungermannia porphyroleuca*, Nees Eur. Leb. II., 78; Gott. and Rab. Hep. Exs. No. 184, 185, 288; Carr and Pears. Exs. No. 172.

On trunks and amongst moss.

Stem serpentine, creeping, radiculose, alternately branched, rather rigid, leaves semi-vertical, spread

ing, or rather ascending, nearly plane, or rarely concave, oval, or quadrate, entire, minutely reticulate, the lower lunately, the upper deeply and obtusely emarginate, two or three toothed, with rather obtuse, unequal laciniæ. Bracts wedge-shaped, at the base convolute, and mostly connate, spreading at the apex, plane, palmately trifid, with the laciniæ bifid, bracteoles small, linear, subulate, bifid or trifid. Perianth oval, plicate above, mouth denticulate. Stipules absent.—(*Plate 4, fig. 55.*)

Jungermannia excisa, *Dicks.*

Stem prostrate, simple; leaves accumbent, subquadrate, lunately marginate; perichætial leaves subtrifid, plicate; stipules none; perianth terminal, cylindrical, plicate; mouth open, dentate, coloured.

Jungermannia excisa, Dicks. Crypt. III., t. 8, f. 7; G. L. and N. Syn. p. 112; Spruce Trans. Bot. Soc. Edin. III., p. 206.

This species has long been a mystery, apart from Dickson's figure. Spruce wrote in 1849: "I fear *J. excisa,* Dicks. t. 8, f. 7, will have to be entirely erased from the list of Hepaticæ. I have spent much time in the attempt to ascertain what it really is, but without success, &c." Subsequently Dr. Carrington wrote: "I quite concur with Mr. Spruce that we have no such British species as *J. excisa.*" He proceeds to enumerate, as Spruce had previously done, the varieties of other species, which were supposed to be referable to *J. excisa.*—(Trans. Bot. Ed. VII., p. 448.)

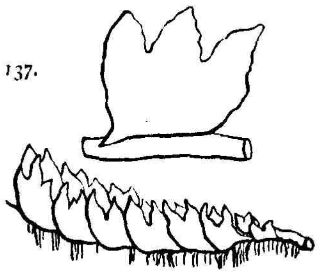
Jungermannia bicrenata, *Schm.*

Stem procumbent, subsimple, leaves erect, rounded-ovate, acutely emarginate; laciniæ acute; perichætial leaves subtrifid, adpressed, rather serrulate; stipules none; perianth oval.

Jungermannia bicrenata, Schmid Anal., p. 247, t. 64, fig. 1; Gott. and Rabh. Exs. 127, 187, 310, 411, 495; Carr. and Pears. Exs. No. 111; Cooke Hep. f. 79, 80. *Jungermannia excisa, Engl.* Bot. t. 2497, Ekart. Jung. t. 11, f. 93.

On sandy soil, &c.

Stem creeping, short, somewhat proliferous; leaves semi-vertical, densely imbricate, connivent above, concave, ovate, or roundish, reticulate, bidentate, with an acute sinus, the laciniæ also acute, margins entire; involucral leaves a little larger, adpressed, acutely bifid or trifid, somewhat serrulate; perianth terminal, ovate, plicate, mouth ciliately toothed, connivent (figs. 136, 137).



137.

136.

Jungermannia turbinata, *Raddi.*

Stems spreading on the ground; leaves suborbicular, loosely reticulate, obtusely bidentate; perichætial leaves axe-shaped, bidentate; perianth turbinate.

Jungermannia turbinata, Raddi. Jung. Etrus. t. III., f. 2, 3; Dumort. Hep. Eur. 79; Carr. and Pears. Exs. 103, 104, 240. *Jungermannia corcyræa*, G. L. and N. Syn. p. 103.

In mountain regions.

Stem creeping, ascending, loosely radiculose, somewhat branched; leaves semi-vertical, spreading, orbicular, repand, and wavy, loosely reticulate, narrowly bifid, sinus obtuse as well as the laciniæ. Involucral leaves axe-shaped, unequally bidentate, spreading at the apex, convolute at the base; perianth obconical or top-shaped, even, obtuse. —(*Plate 4, fig. 56.*)

Jungermannia incisa, *Schrad.*

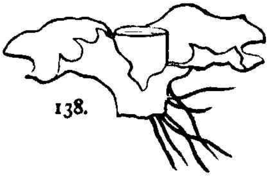
Stem procumbent, nearly simple, compressed, leaves accumbent, concave, quadrate, undulate, subtrifid, incised; perichætial leaves, 3-4-fid, denticulate; stipules none; perianth terminal, obovate, mouth torn.

Jungermannia incisa, Schrad. Samm. 2, p. 5; Hook. Br. Jung. t. 10; Eng. Bot. t. 2528; Gott. and Rab. Exs. 228, 229, 407, 487;

Carr. and Pears. Exs. No. 241 ; Cooke Hep. fig. 82.

In moist places, bogs, &c. (Fr. Winter and Spring.)

Forming small dense patches of pale green, firmly attached to the ground by numerous radicles. Stems prostrate, ¼ inch long, generally simple ; leaves rather distant at the base, become larger and more approximate upwards, subquadrate, a little embracing and decurrent at the base, anterior margin a little involute ; apex three or four toothed, segments unequal, crisped and distorted, their margins frequently toothed (fig. 138). Perichætial leaves trifid or quadrifid, the segments more equal than in the stem leaves. Fruit terminal. Calyx obovate and plicate, contracted, and torn at the mouth. Calyptra obovate, whitish. Elaters bispiral. Gemmæ produced in December and January.



138.

Jungermannia Pearsoni, *Spruce.*

Dioicous, small, stem furcate. Leaves distant, transverse, broadly wedge-shaped, complicately keeled, deeply bifid, segments erect, parallel to the stem, ovate, acuminate. Male inflorescence in the middle of the stem or branches.

Jungermannia Pearsoni, Spruce Journ. Bot., Feb., 1881, p. 33; Carr. and Pears. Exs. No. 165, 239.

On wet rocks.—(*Plate 4, fig. 57.*)

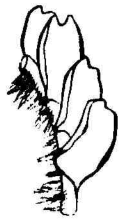
Dioicous, small, depressedly cæspitose, lurid green, resembling *Cephalozia divaricata.* Stem 8 mm. long, flaccid, twice, or rarely more, furcate, radicles very rare. Leaves distant, rarely contiguous, transverse, broadly wedge-shaped, complicately keeled, bifid three-quarters down, keel making a broad angle with the stem ; segments suberect, nearly parallel to the stem, rather plane, ovate, subacuminate, acute or rather obtuse ; cells minute, subquadrate. Andræcia placed in the middle of the stem or branch ; bracts few, three to four, larger than the leaves, crowded, base turgid, sometimes with an antical incurved tooth ; antheridia large, solitary on long pedicels.

Jungermannia orcadensis, *Hook.*

Stem erect, nearly simple ; leaves bifarious, incumbent, appressed or rather spreading, ovate, obtusely emarginate, margin revolute; stipules none.

Jungermannia orcadensis, Hook. Br. Jung. t. 71 ; Gott. and Rabh. Exs. No. 40, 399, 400; Cooke Hep. f. 76 ; Carr. and Pears. Exs. 245. *Mesophylla orcadensis,* Dumort. Hep. Eur. p. 130.

In mountainous districts.



139.

Growing in loose patches, a few inches broad, or scattered amongst mosses. Stems 1 to 2 inches long, erect, thread-like, flexuose, simple, or innovant towards the apex. Leaves close and subimbricate, widely ovate, approaching cordate, spreading or erect and secund, half embracing at the base and decurrent, at the apex with a rather deep obtuse notch (*fig.* 139). Margins recurved. Colour brownish green.

GENUS 26. MYLIA, *Gray*.

Involucre small-leaved, leaves connate at the base. Perianth terminal, elongated, cylindrical, longer than the calyptra, mouth compressed, two-lipped. Capsule four-valved, coriaceous. Elaters double, naked, deciduous. —*Gray Arr. I.*, 693 (1821).

Dioicous. Perianth terminal, laterally compressed from a subterete base, contracted at the apex, at length bilabiate, denticulate; involucral bracts two, spreading from a clasping base. Leaves succubous, bifariously imbricated, alternate, circular, or ovate, and pointed. Amphigastria subulate. Elaters bispiral, deciduous.

Plants forming dense tufts in Alpine bogs, or clinging to the stems of *Sphagnum*. The compressed perianth of *Plagiochila* is combined with general habit of *Jungermannia*.

Mylia Taylori, *Hook.*

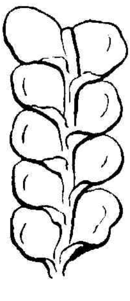
Stem erect, nearly simple, leaves bifarious, accumbent, rounded, concave, entire; perichætial leaves oblong, connate at the base; stipules awl-shaped; perianth ovate, truncate, rather two-lipped.

Jungermannia Taylori, Hook. Br. Jung. No. 57; Gott. and Rabh. Exs. No. 74; Cooke Hep. f. 56, 57. *Mylia Taylori*, Carr. and Pears. Exs. 91, 224; Carr. Br. Hep., p. 68, t. 9, f. 30. *Coleochila Taylori*, Dumort. Hep. Eur. p. 106. *Leptoscyphus Taylori*, Mitten. Hook. Journ. III., 358.

Moist rocks and boggy places. (Fr. Spring.)

Shoots densely cæspitose, erect, innovant, leaves orbicular, coriaceous, horizontally spreading and reflexed from a saccate base; perianth ovate, as long again as the roundish involucral bracts.

140.


141.

Growing in rather large patches. Stems erect, 2 to 4 or 5 inches long, thread-like, flexuous, simple, or sometimes innovant near the extremity. Leaves largest at the extremity of fertile threads, everywhere close and bifarious, slightly imbricating, alternate, horizontally spreading, not unfrequently erect and secund, round or suborbicular, plane or slightly concave; margins entire, sometimes a little

waved, slightly recurved at the extremity, base decurrent, and obliquely half embracing (fig. 141). Substance thick. Colour yellowish-green at the base, assuming a purplish tint towards the extremity. Stipules minute, widely subulate (fig. 140). Perichætial leaves one erect pair at the base of the calyx, margins a little waved. Calyx ovate, not plicate, cylindrical, but compressed at the apex, and truncate, obsoletely toothed, and two-lipped. Capsule dark brown, furrowed. Elaters short, bispiral.

Mylia anomala, *Hook.*

Shoots scattered, creeping, mostly simple; leaves rather distant, subsecund, diversiform, roundish-ovate, obtuse to ovate, acuminate, concave; texture thinner than in *M. Taylori*. Perianth ovate-oblong, thrice the length of the involucral bracts, which are ovate.

Jungermannia anomala, Hook. Br. Jung. No. 34; Eng. Bot. t. 2518. *Jungermannia Taylori* v. *anomala*, Nees Eur. Leb. II., 455; Gott. and Rabh. Exs. 113, 236, 414, 415. *Coleochila anomala*, Dumort. Hep. Eur. 106. *Mylia anomala*, Carr. and Pears. Exs. No. 225. *Mylia Taylori anomala*, Carr. Br. Hep. p. 70, t. 9, f. 29.

In scattered tufts among *Sphagnum*.

Sir W. Hooker states that the principal difference between these two species consists in the

ovate and acute leaves of *M. anomala*, which are wholly wanting in *M. Taylori*. Other marks, much less to be depended upon, may be found in the densely-crowded patches in which *M. Taylori* grow, so that the individuals are forced into a nearly erect position, and in the colour, which is far deeper and generally with a purplish tinge throughout. Dr. Carrington recognises the two as subspecies.

GENUS 27. **GYMNOCOLEA**, *Dum.*

Involucre small-leaved, distinct, conforming to the stem leaves. Perianth erect, stipitate, naked, terete, contracted at the apex, mouth denticulate. Capsule four-valved, coriaceous, naked. Elaters double, naked, deciduous.—*Dumort. Syll.* 52 (1831).

Plants without stipules, leaves subcurrent, flattened, two-lobed. Perianth exserted.

Gymnocolea inflata, *Huds., Dum.*

Stem ascending, branched; leaves bifarious, remote, accumbent, roundish, acutely bifid ; stipules none ; perianth terminal, pear-shaped.

Jungermannia inflata, Huds. Aug. p. 511 ; Hook. Br. Jung. No. 38 ; Eng. Bot. t. 2512 ; Gott. and Rab. Exs. 145, 174, 253, 311, 390, 450, 482, 485, 494, 497 ; Carr. and Pears. Exs. No. 28, 29 ; Cooke Hep. f. 75.

Gymnocolea inflata, Dumort. Rev. Jung. p. 17.

Moist heaths and boggy places. (Fr. Mar. Ap.)

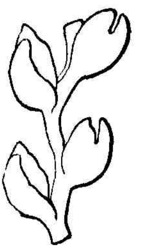
var. α *compacta*, Carr.

A curious variety with inflated umbilicate perianths, and very short tufted stems.

var. γ *laxa*, Carr.

On heaths and bogs.

Growing in densely-matted patches of considerable extent, deep green, nearly black. Stems ¼ to ½ inch or more, procumbent, filiform, simple, or with two or three scattered branches, now and then innovant. Leaves bifarious, distant in the lower part of the stem, imbricated above, horizontal, spreading or erect, frequently concave, divided less than half way by an acute sinus (fig. 142). Perichætial leaves similar and smaller. Calyx terminal, at first nearly spherical, then pear-shaped or obovate, with a tapering base, somewhat plicate above, mouth contracted, with a few obtuse unequal teeth. Capsule slightly furrowed. Elaters bispiral.



142.

"The singular form of the full-grown calyx, the obtuse segments of the leaves, together with the deep olive, almost black, colour, are marks by which this may be known from every other species."—*Hooker.*

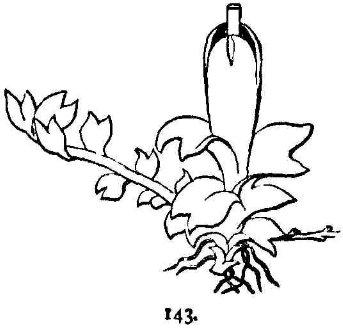
Gymnocolea affinis, *Wils., Dum.*

Stem procumbent, without stipules, leaves rounded, hyaline, acutely bifid ; laciniæ obtuse; perichætial leaves spreading. Perianth pear-shaped, contracted at the apex, mouth dentate.

Jungermannia affinis, Wils. in Brit. Fl. V., 111. *Jungermannia turbinata*, Wils. Eng. Bot. Supp. t. 2744. *Jungermannia Wilsoniana*, Nees Eur. Leb. III., 548 ; Gott. and Rab. Exs. 447 ; Cooke Hep. f. 74. *Gymnocolea affinis*, Dumort. Hep. Eur. p. 65.

In moist shady places under banks. (Early Spring.)

Stems procumbent, simple or branched, leaves roundish, concave, acutely bifid, coarsely reticulated, the segments obtuse, those of the involucre larger than the rest; fruit terminal; perianth pear-shaped, plicate, contracted, and toothed at the mouth. (fig. 143).



143.

Separated from *J. inflata*, to which its trivial name applies, by the procumbent stems, large reticulations, and less obtuse segments

of the leaves, and, above all, the plicated upper portion of the perianth. Perigonial leaves on separate shoots crowded, concave, sometimes three-toothed, anterior segment inflexed, forming an auricle.

GENUS 28. HARPANTHUS, *Nees.*

Dioicous. Involucre small-leaved, lateral, incurved from the interposition of two stipules, dissimilar to the leaves. Perianth fusiform, terete, mouth three or four fid, laciniæ unequal, entire, connate at the base with the calyptra, which is adherent up to the middle, apex free. Capsule four-valved, coriaceous, naked. Elaters double, naked, deciduous.—*Nees Eur. Leb. II.*, 351.

Plants stipulate, leaves subcurrent, flattened, divided.

Fertile shoots very short, ventral, at length sublateral. Perianth exserted, terete, the lower half thickened; mouth contracted, three to four toothed. Calyptra fleshy, confluent two-thirds with the perianth. Involucral leaves one or two pairs. Leaves succubous, ovate, emarginate, semi-vertically imbri cate, secund. Amphigastria lanceolate, connate with adjacent leaves, free margin reflexed, one-toothed at the base. Male shoots slender, perigonial leaves terminal, enclosing one to two antheridia.—*Carr. Br. Hep.* 47.

Harpanthus Flotovianus, *Nees.*

Stem ascending, leaves approximate, orbicular-ovate, obtusely emarginate; stipules ovate-lanceolate, bifid or entire, equally acuminate; perianth cylindrical, subsessile.

Jungermannia Flotoviana, Nees Fl. Ratis. 1833, p. 408. *Harpanthus Flotovianus*, Nees Eur. Leb. II., 353; Gott. and Rab. Exs. 379, 417; Carr. and Pears. Exs. No. 265. *Pleuranthe olivacea*, Tayl. Lond. Journ. V., 282 (1846); Lindb. Hep. Hibern. 516.

Amongst *Sphagnum*, on wet rocks. (Fr. Spr. and Sum.)

Stems ½ to 2 inches, flexuous, procumbent, creeping amongst mosses, mostly unbranched, sometimes several stems from an old growth, of a delicate green or tinged with brown; rootlets white, short. Leaves ovate, orbiculate, horizontal, insertion of upper part in line with the stem, base decurrent, curved forward. Apex contracted, emarginate, sinus small and shallow, segments rounded, upper tooth sometimes larger and acute, then overhanging like a claw. Young shoots light green or light olive, older plants often with a reddish tinge. Stipules large, very distinct, ovate, ovate-lanceolate, or lanceolate, acute, inserted obliquely, some entire, others with a tooth on the outer side about the middle, rarely toothed on both sides. Leaf cells hexagonal. Dioicous. Male

plants smaller, antheridia single at the base of each swollen leaf. Perianth from the axil of a stipule, subcylindrical, slightly sickle-shaped, pale greenish, mouth pointed, at first notched on one side, and finely crenulate. Calyptra campanulate. Capsule oval, brown, four-valved. Elaters bispiral.—(*Plate 5, fig. 62.*)

Harpanthus scutatus, *W. and M., Spruce.*

Stem ascending, simple; leaves erect, rounded, concave, acutely emarginate, perichætial 3-4-fid; stipules triangular, acuminate, one tooth on each side; perianth lateral, ovate.

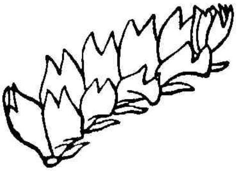
Jungermannia scutata, Web. and Mohr. D. Crypt. 408; Hook. Br. Fl. V., p. 118; Mack. Hib. II., 64; Gott. and Rab. Exs. 218, 354, 466; Cooke Hep. f. 72. *Jungermannia stipulacea*, Hook. Br. Jung. t. 41; Eng. Bot. t. 2538. *Harpanthus scutatus*, Spruce Trans. Bot. Edin. III., 209; Carr. Br. Hep., p. 49, t. 17, f. 52.

On rocks or trunks.

var. *imbricatus*, Carr. and Pears. Exs. No. 264.

Growing in dense compact tufts, pale olive, olive-brown or brown. Stems decumbent, rootlets numerous. Leaves bifarious, imbricate, erect, roundish-ovate, sharply bidentate, with an acute

sinus, margins entire (fig. 144). Amphigastria large, spreading, lanceolate-acuminate. Diocious. Involucral bracts two, the upper one adnate at the base ; segments acute, sharply dentate. Perianth contracted above, at length faintly 3-4 plicate ; apex slightly crenate, splitting on one side. Calyptra connate. Capsule oval, deep brown ; spores spherical, rufous brown, 10μ diam. Elaters bispiral. Male plants distinct, densely cæspitose.



144.

GENUS 29. **SACCOGYNA**, *Dumort.*

Involucre none. Perianth affixed laterally by the margin of the apex, saccate, pendulous, naked, smooth, or everywhere pilose ; mouth circular, base connate with the calyptra, not bearded at the insertion. Capsule naked, four-valved, valves straight. Elaters double, naked, deciduous.—*Dumort. Comm. p.* 113 (1822) ; *Hep. Eur. t.* 3, *f.* 33.

Dioicous. Perigynium at first bud-like, inferior, proceeding from the axil of an amphigastrium, at length oblong, pendulous, fleshy, sublateral, shortly stipitate, surmounted by the remains of the involucral bracts. Perianth wanting. Calyptra connate, for most of its length with the outer walls, the dome-like apex alone free. Capsule oblong, quadrivalvate. Male spikes minute, inferior, rising

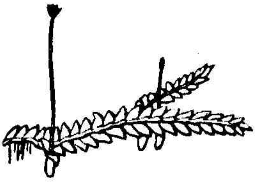
from the amphigastria of separate individuals.—*Carr. Brit. Hep. 44.*

Saccogyna viticulosa, *Linn.*

Stem procumbent, branched; leaves accumbent, ovate, entire; stipules ovate-lanceolate, margin denticulate.

Jungermannia viticulosa, Linn. Sp. 1597; Eng. Bot. t. 2513; Hook. Br. Jung. t. 60; Mack. Hib. II., 63. *Saccogyna viticulosa*, Dumort. Comm. p. 113; Cooke Hep. f. 115, 116, 117, 118; Carr. and Pears. Exs. No. 12, 13, 14; Carr. Br. Hepat., p. 47, t. 9, f. 28.

Shady rocks in woods and heaths.

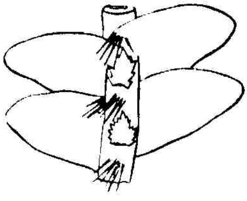


145.

146.

Attached to *Sphagnum*, or the surface of rocks, forming depressed patches several inches in circumference. Stems filiform, slightly flexuous (fig. 145). Innovations distant. Rootlets sparse. Leaves distichous, closely imbricate, alternate, horizontal, plane, ovate, obtuse with a broad subdecurrent base (fig. 147); margin

entire. Green, ochraceous, or olive-brown. Amphigastria 2-3 dentate (fig. 146). Dioicous. After impregnation the fleshy base of the receptacle elongates and descends into the earth as a hollow oblong pouch, attached to the stem by its upper border (fig. 148). Capsule reddish-brown, quadrivalvular. Spores 15μ diam., reddish-brown.



147.

148.

Genus 30. NARDIA, *Gray*.

Dioicous. Perianth connate with involucral leaves to form an urceolate involucre; stoloniferous at the base. Shoots ascending or erect, innovations ventral. Leaves distichous, subvertical. Amphigastria present only in species with round leaves. Andræcium terminal, subspicate.—*Carr. Hep.* 10.

Gray Arr. B. Pl. (1821). *Alicularia,* Corda Opiz. Beitr. (1829). *Mesophylla,* Dumort. *Southbya,* Spruce Trans. Ed. III., p. 197. *Marsupella,* Spruce; see "Nardia" in Spruce Hep. Amaz. p. 518.

Dr. Carrington, in referring to the ramification in this genus, says that, instead of the ordinary furcate division of the stem, the annual shoots spring from

the ventral aspect, and may be called adventitious. Thus, if we isolate one or two colesuliferous stems from a luxurious tuft, at first view the central axis appears continuous, and the shoots interrupted at pretty regular intervals, each of which bears an involucre at the apex. But on careful examination we find that the axis is not continuous, but that each younger stem originates from the axil of an amphigastrium beneath the involucre of the former season. Other innovations may spring from different parts of the ventral aspect, or very rarely from the axil of a leaf; but only one of these is continued in the line of the main stem.

Spruce contends for the separation of *Marsupella* from *Nardia*, on the ground that the stem with the leaves is compressed from the *front*, and not from the side. That stipules are not present, whilst they are in *Nardia*. That the leaves are transverse, against succubous in *Nardia*. That the leaves are complicate or carinate in *Marsupella*, but not in *Nardia*, and that the perianth is compressed from the *front* in *Marsupella*, and from the side in *Nardia*. *See Revue Bryologique, 1881, p. 92.*

Nardia sparsifolia, *Lindb.*

Leaves scattered. Cortical stratum of stem simple. Leaves acutely incised. Lobes rather acute, margin straight. Bracts connate below the middle, lobes slightly inflexed, rather concave, lobes of involucre acute. Calyptra large.

Nardia sparsifolia, Carr. Brit. Hep. p. 21. *Sarcoscyphus sparsifolius*, Lind. Musci. Novi.,

1868, p. 280. *Marsupella sparsifolia*, Lind. Not. pro Fauna, &c., Fenn. IX., 1868; Pears. Journ. Bot. Aug., 1884, t. 248; Dum. Hep. Eur. 128; Carr. and Pears. Exs. 220. *Nardia Funckii* var. *major*, Nees.

On rocks in Alpine situations.

Paroicous, rather robust, few-leaved, cortical stratum of the stem simple, leaves acutely incised, lobes rather acute, margin erect, involucral bracts connate to near the middle, lobes slightly inflexed, very concave, those of the involucre acute; calyptra large.

Plants rather stout, densely cæspitose. Stems ascending, entangled, slender, flexuose, fastigiately branched, radiculose at the base, and producing long stolons, few-leaved, cortical stratum simple. Leaves accrescent, margin erect, inferior ones patent from a somewhat contracted base, quadrate ovate, *subamplexicaul, acutely emarginate, lobes rather* acute, plane, superior ones with a broader base, subvaginate and saccate, broadly ovate, erecto-patent, bearing two antheridia in their axils. Involucral bracts resembling the upper leaves, erect, connate below the middle, lobes slightly inflexed, rather concave. Involucre four or five fid, lobes acute. Professor Lindberg thinks that *Nardia adusta* and *N. sparsifolia* should be united in one species.—(*Plate 5, fig. 64.*)

Nardia conferta, *Spruce*.

Stems prostrate, simple or branched; leaves closely imbricate, secund, broadly oval, acutely

bifid; segments acute; bracts larger than the leaves, innermost free, or sometimes confluent.

Sarcoscyphus confertus, Limpr. Jahres. Schles. Ges., 1880, p. 313. *Gymnomitrium confertum,* Limpr. Flora, 1881; *Marsupella conferta,* Spruce Journ. Bot., Sept., 1892, t. 327; Revue Bryol., 1881, p. 95.

In Alpine situations.

Autoicous, cæspitose or straggling amongst mosses, pale yellowish green to reddish brown. Stems simple, ½ to 1 inch long, or branched, prostrate, flexuous, filiform, terete, denudate at the base, branches short, ascending, cortical cells with slightly firmer walls, radiculose, rootlets fasciculate, short. Leaves closely imbricate, bifarious from a vaginate base, appressed, erect, on fertile stems gradually accrescent, oval, bifid to about one-fifth, sinus and segments acute. Cells minute, or very minute, indistinctly 5-6 angled. Female flowers terminal on short branches, or on main stem, bracts larger than the leaves, oval or oval rotund, innermost bracts free (or sometimes united into a tube), small, tender, margin irregular. Archegonia five to ten, dispersed over the calyptra. Pedicel long, thick, capsule dark brown, almost spherical. Spores yellowish-brown, granulate. Elaters three to four spired, sometimes furcate. Andræcia spicate on the main stem or short branches. Male bracts ovate, a little swollen at the base. Antheridia solitary, stipitate.—(*Plate 5, fig. 63.*)

Nardia Stableri, *Spruce.*

Dioicous. Stem creeping or erect, branched. Leaves subimbricate, erect, broadly ovate, quadrate, complicately keeled, bilobate; lobes acute. Female flowers terminal, opposite innovations. Bracts larger than the leaves. Perianth cylindrical, when mature half adnate; mouth fimbriate.

Marsupella Stableri, Spruce; Rev. Bryol., 1881, p. 96; Carr. and Pears. Exs. No. 153.

On rocks.

Dioicous, small, densely cæspitose, brownish-green, becoming purple, resembling copper wire, at the head rosy-purple. Stem from a rhizomatose base, small leaved, rarely without leaves, somewhat erect or creeping, thread-like, ¼ to ⅜ inch long, and branched; branches fastigiate, equally foliose, female clavate, often dichotomous, or fasciculately innovant. Leaves subimbricated, subpellucid, erect, adpressed, broadly ovate-quadrate, complicatedly keeled to one-half or one-third, bilobate, lobes acute, rarely acuminate, entire or rarely with a tooth. Cells hexagonal. Lower cauline leaves and all those of sterile branches minute, closely adpressed. Andræcia terminal or median on stem or branches, bracts three, large, two to three times larger than adjacent leaves, ventricose, bilobed one-third. Female flowers terminal, opposite innovations, bracts much larger than the leaves, not crowded, adpressedly imbricate, broadly ovate, ventricose below, keeled above, bi-

lobate, lobes plane, ovate, subacuminate, and denticulate, exterior bracts much smaller, and less deeply cut. Perianth when young, ovate, tubular, turgid at the base, nearly free, mouth rosy ciliate; when mature half adnate, mouth fimbriate. Calyptra not much shorter. Capsule oblong-globose on a short pedicel. Spores even. Elaters bispiral.—(*Plate 6, fig. 77.*)

Nardia olivacea, *Spruce.*

Cæspitose, small, rhizome creeping, without leaves, apex erect. Leaves small, imbricate, oblong, concave, or keeled, bilobed, sinus and lobes obtuse. Bracts concave, shortly bilobate, larger. Perianth variable, concrete half way, mouth toothed.

Marsupella olivacea, Spruce Revue Bryol., 1881, p. 97. *Sarcoscyphus Sprucei β decipiens*, Limpr. Flora; Jahresber Schleis., 1881. *Sarcoscyphus adustus*, Gott. and Rab. Exs. 648 (partly).

On rocks.

Synoicous and paroicous, small, cæspitose, olive green. Stem $\frac{1}{8}$ to $\frac{1}{4}$ inch long, rhizome creeping, subdivided, without leaves or with small ones, apex erect, simple or innovant, fertile clavate above, sterile thread-like. Leaves small, thick, opaque, subimbricate, erect, adpressed, the upper sometimes spreading at the apex, decurrent and vaginate at the base, oblong, concave or keeled, $\frac{1}{4}$-$\frac{1}{3}$ bilobed, sinus obtuse, lobes obtuse, rarely abruptly subacute, cells minute. Invo-

lucral bracts terminal, fusiform, 3-4-jugate, broadly ovate, concave, very shortly bilobed at the apex, lobes incurved, obtuse, rarely rounded, larger than neighbouring leaves, base slightly connate, apex cut down one-third. Antheridia solitary in the axils of the bracts. Pistillidia five, rarely ten. Perianth variable, now and then as long as the involucre, oblong, rarely closed at the apex, or one side shorter and gaping, mouth laciniate, concrete half way up with the involucre, rarely wholly free. Calyptra globose-oval, smaller, upper half bearing four to nine sterile pistillidia. Capsule oblong-globose.

Nardia ustulata, *Spruce.*

Paroicous, rhizome creeping, stems somewhat erect, almost simple, clavate. Leaves imbricate, oval, bilobate, sinus and lobes acute, subcomplicate. Perianth immersed, apex angular, concrete at the base, with the involucre at length lobed.

Gymnomitrium adustum, Nees Eur. Leb. (partly). *Marsupella ustulata*, Spruce Revue Bryol., 1881, p. 100; Carr. and Pears. Exs. 219. *Sarcoscyphus adustus*, Spruce Musc. el Hep. Pyr.; Gott. and Rab. Exs. 648 (partly).

On rocks or stones.

Tufts rarely green, for the most part purple brown, or as if scorched, becoming more or less black. Rhizome creeping, flexuous, stems somewhat erect, almost simple, rarely innovant,

clavate and fertile, a few equal and sterile. Leaves of sterile stems smaller, less imbricate, spreading, broadly oval or roundish; bilobate, sinus acute, lobes acute. Flowers terminal, paroicous. Bracts two to five, joined, rarely two, twice as large as the leaves, ovate, orbicular, subcordate at the base, ventricose, bilobed. Antheridia twin, rarely solitary, globose. Perianth immersed, apex obscurely 4-5 angled, at length lobed, base concrete, with the involucre. Calyptra globose-oval, constricted at the base, with six to eight sterile pistillidia. Capsule four-valved, the valves sometimes bilobed. Elaters bispiral, obtuse.

It grows, in broad low patches, of a reddish or purplish brown colour on the surface, as if scorched. The parts not exposed to the light paler and more tender. On stones in moist sites, under trees the plants are often greener, only the tips slightly browned, but on exposed sub-alpine rocks the whole plant becomes of a purple black.—(*Plate 6, fig. 75.*)

Nardia emarginata, *Ehr., Gr. and Benn.*

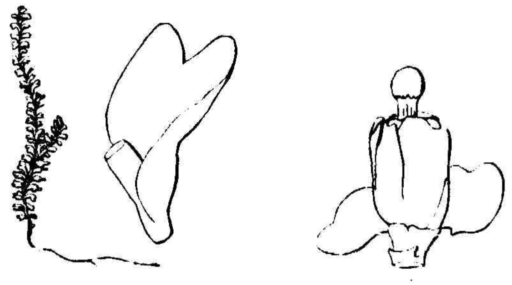
Stems rigid, simple or innovant from the apex; leaves loosely imbricate, round or subcordate, base broad, embracing the stem, emargination shallow, lobes obtuse or apiculate, basal margin reflexed, texture firm and polished; involucre urceolate, connate for more than half its length, segments retuse.

Jungermannia emarginata, Ehr. Beitr. III.,

p. 80; Hook. Br. Jung., t. xxvii., Brit. Fl. V., I., p. 110; Eng. Bot. I., t. 1022. *Jungermannia macrorhiza*, Dicks. Crypt. II., t. 5, f. 10. *Nardius emarginatus*, Gray and Benn. Arr. I., p. 964. *Nardia emarginata*, Carr. Br. Hep., p. 13, t. 2, f. 7; Carr. and Pears. Ex. 77, 78, 154, 155, 156 (var.); Mass. and Ces., t. x., f. 1. *Sarcosyphus Erhardtii*, Corda Sturm. II., 19, 20, p. 25; Gott. and Rabh. Exs. 256 (form acuta), 255 (form obtusa); Cooke Hep. figs. 23, 24, 25.

Common on borders of sub-alpine streams, in the spray of waterfalls. (Fr. April.)

The following varieties and forms have been distinguished:—



149. 150. 151.

var. α major. Shoots 1½ to 3 inches long, compressed. Stems rigid; leaves rather distant, divergent, less concave, cordate, emarginate, rounded and reflexed at the base, olive,

olive brown or purple, sometimes nearly black.

* Form *acutiuscula*. Lobes divergent, abruptly apiculate.

** Form *obtusa*. Lobes rounded, obtuse.

var. β *aquatica*, Ldg. Shoots long, straggling, repeatedly innovant, naked or ramentose at the base, leaves irregular in outline, often erose, 2-3 lobed, undulate, sordid olive green.—*Ldg. Hep. Eur.* 75.

In running water.

var. γ *minor*. Smaller. Shoots subterete; leaves more closely imbricate, erecto-patent, subcomplicate, round or subquadrate; lobes bluntly apiculate, margin nearly plane, olive brown or fawn-colour, sometimes livid green. —*S. Ehrharti* γ *julacea*, Nees.

On exposed rocks.

No short description can be given of such a variable species, consistent with the bulk of this volume. It is one of the most easily distinguished of our common Hepatics. Ehrhart compares the form of leaf to a heart cut out of paper. When occurring in mass on wet rocks by a mountain stream it is beautiful and conspicuous. The spores are round, fulvous 15μ diam. Gemmæ are occasionally met with at the apex of the stem and terminal leaves, they are elliptic, two or three septate, and of a pale brown colour.—(*Plate 5, fig. 69.*)

Nardia robusta, *Du.*

Growing in tufts, stems erect ($1\frac{1}{2}$ c. m.), innovant at the apex, robust, leaves olive or rubiginous, circular when expanded, with an obtuse, rather lunate, shallow sinus at the apex ; when growing, loosely imbricate, distichous, deeply concave.

Sarcoscyphus Ehrhardtii robustus, De Not. Comm. Ital. fig. iv. *Nardia robusta*, Lindb. Carr. and Pears. Exs. No. 157.

Dr. Carrington writes that: "*N. robusta* Lind. seems to me only a stouter variety of *N. emarginata* with nearly black stems and more distant, cordate leaves, which are seated at right angles with the stem, less concave, sometimes plane or slightly convex, and of firmer texture. The colour is an obscure indigo green, turning black, but otherwise scarcely altered when dry."

Nardia alpina, *Carr.*

Dioicious. Densely cæspitose, stems rigid, leaves patent, approximate, orbiculate, vertically concave, lobes obtuse, connivent, sinus acute; involucral leaves larger, convolute, involucre short, nearly immersed ; cells smaller, glossy pitch black.

Nardia alpina, Carr. and Pears. Exs. No. 79, 158*a*, 158*b*. *Sarcoscyphus alpinus*, Gott.

and Rabh. Exs. No. 453, 535. *Nardia emarginata δ picea,* Carr. Br. Hep. p. 14.

On rocks.

var. *laxior,* Carr. and Pears. Exs. No. 80.

The plant is intensely black, a warm brown by transmitted light, barren shoots ½ inch, prostrate at the base, with pectinate pinnate leaves, exactly round inflexed obtuse lobes, and acute sinus, equal to one-third or one-fourth of the length, very convex and narrowed at the base; fertile shoots stouter, with large involute involucral leaves which nearly hide the short roundish involucre; leaf cells smaller than in var. *minor* of *N. emarginata;* the marginal ones more minute; the perigonial leaves are fewer in number, and terminal.—*Carr. l. c.* —(*Plate 5, fig.* 66.)

Nardia revoluta, *N., Lindb.*

Stems matted and stoloniferous at the base, densely tufted; leaves subcomplicate, erecto-patent, imbricate when dry, rigid, round or elliptic from a narrower half-embracing base, deeply and acutely bidentate, margin narrowly reflexed throughout; involucral leaves resembling those of the stem but larger.

Sarcoscyphus revolutus, Nees Leberm. II., 419, iv., 34. *Jungermannia atrata,* Mitt. Hep. E. Ind. p. 90. *Nardia revoluta,* Carr. Grevillea II., p. 88, t. 18, f. 19-25. *Gym-*

nomitrium revolutum, Carr. and Pears. Exs No. 217, 218.

Densely cæspitose in black tufts.

Base stoloniferous, dark brown, brittle, sparingly rooting; shoots ascending, simple, ½ inch to 1 inch long, rigid, innovations from the apex, or axils of upper leaves. Leaves bifarious, imbricate, complicate-concave, bidentate, erect, roundish or elliptic-obovate from a rather narrowed base; smaller and more distant near the base of the stem, gradually enlarging upwards. Lobes equal, acute, cuspidate, with a deep sinus, about one-third. Margin narrowly reflexed. Texture dense, polished, pitch-black.

In size and emargination of the leaves it is intermediate between *N. emarginata* and *N. Funckii*, but the narrow revolute continuous border will at once distinguish it from these. The leaves of *N. emarginata* are usually reflexed at the base, but the lobes are blunter, and plane at the margin.—(*Plate 5, fig. 71.*)

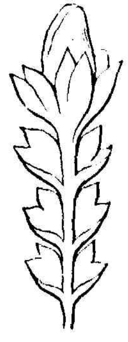
Nardia Funckii, *W. and M., Carr.*

Densely cæspitose; stems very short, erect, rigid, fastigiate-innovate; leaves approximate, erectly spreading when moist, erect when dry, subrotund, carinate, concave, acutely emarginate, lobes acute; involucral leaves much larger; involucre ovate, lower half connate, acutely bilobed, the segments incurved; two to four lines.

Jungermannia Funckii, Web. and Mohr., p. 422. Eckart. Syn. Jung. p. 14, t. 13, f. 3, 112-113. *Sarcoscyphus Funckii*, Nees Leberm. I., p. 135; Gott. and Rab. Exs. No. 86, 54, 461; Spruce Hep. Pyr. V., III., p. 197; Cooke Hep. fig. 26. *Nardia Funckii*, Carr. Brit. Hep. p. 17, t. ii., f. 6 (p.p.); Carr. and Pears. Exs. No. 82, 83.

Forming large dark patches on siliceous or argillaceous rocks.

var. β *robustior*. Shoots compressed, stouter; leaves approximate, twice the breadth of the stem, elliptic-obovate, complicate; lobes inflexed, dark-brown, polished, two to six lines.



152.

* *diffusa*. Stems longer, intricately and repeatedly innovant, fastigiate; leaves more remote, subvertically spreading, not unfrequently subsecund, lobes divergent; reddish brown, or dark brown, polished, ½ to 1 inch.

Stems creeping, intricately matted at the base, which is naked or beset with remains of old leaves, ascending, rather thick, rigid, at first simple, producing innovations from the terminal axis of the shoots, or axils of the leaves, brown or nearly black; shoots slightly compressed, subclavate, or when barren attenuate. Rootlets confined to the creeping portion. Leaves scarcely wider than the

stem, somewhat smaller and more distant near the base; round or subquadrate, sometimes roundish-ovate, acutely emarginate, sinus one-third to one-fourth; lobes equal, divergent. Leaves loosely imbricate, half embracing, very concave, inflexed at the base. Olive-brown, lurid-brown, or pale olive, smooth. Dioicous. Fertile shoots thickened upwards, shortened; involucral leaves two or three pairs, suddenly enlarged, broadly ovate, lobes rather obtuse, sinus acute. Involucre conspicuous, ovate, of two convolute leaves, connate half their length; lobes acute, at first connivent, then erect. Perianth adnate with and hidden by the outer involucral bracts, apex at first entire, afterwards split. Calyptra obovate. Capsule very minute, pale reddish-brown, valves ovate, spores brown 15μ diam. Elaters bispiral, flexuous. This species is rarely met with in fruit.—(*Plate 5, fig. 65.*)

Nardia adusta, *N., Carr.*

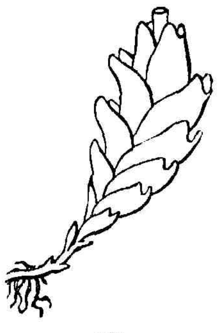
Paroicous. Shoots very minute, clavate, terete; leaves few, vertically imbricate, accresent, subcomplicate, round or broadly ovate, from a ventricose sheathing base, acutely bilobed, the sinus angular; cells large, hyaline; involucre ovate, conspicuous; segments erect, acute, lower half adnate.

Gymnomitrium adustum, Nees Leberm. I., 120; Cooke Hep. f. 15. *Acolia brevissima*, Dum. Syll. p. 76. *Sarcoscyphus adustus*, Spr. Hep. Pyr. p. 196. *Nardia adusta*, Carr. Brit.

Hep. 20, t. ii., fig. 6, in part; Carr. and Pears. Exs. No. 5. *Nardia Sprucei*, Mass. and Carr. Epat. Alp. 222.

On sandstone rocks. (Fr. Early Summer.)

Primary shoots stoloniferous, creeping, attached to the ground by numerous rootlets, mostly forming patches of a lurid brown colour, as if scorched. Stems ascending, one or two lines high, thick, fleshy. Barren shoots scarcely one-third the diameter of the fertile ones, of nearly the same thickness throughout. Leaves increasing in size upwards, distant, seldom more than five to eight pairs, bifariously imbricate, vertical, upper ones gradually enlarging, closely appressed, complicate-concave (fig. 153), elliptic-ovate or broadly ovate from a dilated saccate base; apex acutely emarginate, lobes angular, sinus acute, one-fourth of the length. Texture firm, translucent, pale yellow or olive. Inflorescence paroicous. Antheridia occupying the same perichætium as the pistillidia, but arising from the axil of the lower bract. Fertile shoots clavate. Involucral leaves half the length of the involucre, broadly ovate, lobes rather obtuse, connivent. Involucre equal in length to the rest of the stem. Perianth half as long as the involucre, apex free, conical, at first contracted and crenate, afterwards irregularly lobed. Calyptra large, obovate.



153.

Nardia Muelleri, *Nees.*

Stems erect, branched, flagelliferous; leaves subquadrate, obtusely emarginate; laciniæ ovate, obtuse; involucral deeply dissected, acutely bifid.

Jungermannia pulvinata, Raddi. Etrusc. t. 4, f. 5. *Sarcoscyphus Muelleri*, Nees Eur. Leb. I., p. 132. *Nardia Muelleri*, Carr. in Hep. Exs.

var. *ligurica-viride*, Carr. and Pears. Exs. No. 81, without diagnosis.—(*Plate* 7, *fig.* 85.)

In the type the stems are erect, somewhat dichotomously branched, and flagelliferous, leaves approximate, rather rounded or subquadrate, broader than long, rather spreading and concave, obtusely emarginate, with a rather acute sinus, involucral leaves similar, deeply and acutely bifid, with acute laciniæ. Perianth terminal, ovate, immersed in the involucre.

Nardia repanda, *Lind.*

Paroicous. Stems more slender, fragile, ascending, innovant; branches slender; leaves distant, subvertical, orbiculate, concave, saccate and embracing at the base; margin erect, more or less undulate, emarginate; texture thin, hyaline; the cells larger, thin walled; involucre obovate-clavate; bracts

subreniform, repand-lobate; upper amphigastria ovate, 3-4 dentate; pale green.

Jungermannia scalaris β repanda, Hüb. Hep. Germ. p. 81 (partly). *Jungermannia silvrettæ*, Gott. and Rab. Exs. 470. *Nardia repanda*, Lindberg. Carr. Br. Hep. p. 27.

Stems ⅓ to ½ inch. Professor Lindberg states that it is the common form in Finland. It has been confounded with *Jungermannia capitata*, the large form of which it resembles in the delicate crisped hyaline leaves, and large areolæ.—(*Plate 6, fig. 76.*)

Nardia sphacelata, *Gies., Carr.*

Stoloniferous. Stems slender, flexuous; leaves rather distant, spreading vertically, obovate, from a narrower sheathing base, emarginate; lobes ovate, rounded; sinus acute; margin plane or inflexed; involucre oblong, connate at the lower third only; segments deeply lobed.—*Carr.*

Jungermannia sphacelata, Gies. in Lindbg. Syn. Hep., p. 76, t. i., f. 9, 13. *Sarcoscyphus sphacelatus*, Nees Eur. Leb. I., p. 129; Gott. and Rab. Exs. 519, 255. *Nardia sphacelata*, Carr. Trans. Bot. Soc. Edin., 1870, p. 378; Carr. Brit. Hep., p. 11, t. 2, f. 5; Carr. and Pears. Exs. No. 4.

Forming extensive livid tufts on the borders of Alpine streams. Scotland, Ireland.

Stems stoloniferous at the base, erect, tender, flexuous, pale-brown. Shoots 1 to 3 inches, simple, appearing branched by the growth of innovations. Stolons creeping, naked, or with bundles of rootlets, which latter are rare on the erect shoots. Leaves smaller at the base, rather distant, obovate, or obcordate, bilobed, lobes equal, sinus narrow, margin plane, or undulate, inflexed at the base. Texture thin and tender, pale pellucid olive when moist, brownish purple at the apex. Dioicous. Fertile stem thickened at apex. Involucral leaves larger than the rest, spreading, cordate, deeply lobed. Involucre of two convolute leaves, connate at the lower third, lobes acute, inflexed. Perianth with the apex free, divided into four or five broad segments, shorter than the involucre. Calyptra campanulate, pistillidia attached to the walls. Capsule small, blackish brown, spores reddish brown, 15μ diameter. Antheridia one to three, olive green, on slender pedicels.—(*Plate 5, fig. 68.*)

Nardia Carringtonii, *Balf.*

Primary stems rhizomatous, creeping; branches erect, laterally compressed, recurved at the apex; leaves of firm texture, secund, obliquely subreniform, approximate; concave, vertically appressed; margins approximate to each other. Anterior margin narrow and decurrent; posterior abruptly rounded.

Adelanthus Carringtonii, Balf. Trans. Bot. Soc. Edin. X., 380; Dum. Hep. Eur. 47;

Carr. and Pears. Exs. No. 97, 233. *Nardia Carringtonii*, Carr. Br. Hep. p. 27, t. x., fig. 31.

In boggy places, Scotch Highlands.

Stems two to four lines high, by a line in breadth, of a brownish colour, slender, rigid, flexuose, of a dense texture, naked, or a few scanty white rootlets. Barren shoots 2 to 4 inches high, simple, or with occasional innovations from the axils of amphigastria. Leaves nearly uniform, subvertically imbricate, appressed, obliquely orbicular, or reniform, entire, or obscurely truncate, very concave, ventral border rounded, and inserted at right angles to the stem, anterior narrow and decurrent. Colour uniform straw, or pale olive green. Amphigastria rare, except at apex of young shoots, long and slender, subulate, erect. Inflorescence dioicous. Andræcium spicate, terminal. Perigonial leaves more rounded and convex, gibbous at the base, posterior lobe subquadrate, inflexed. Antheridia two to three in each leaf, round, or obovate.

At first sight resembling *N. compressa*, but quite distinct, which is supported by the cell structure.—(*Plate fig. 7, 82.*)

Nardia scalaris, *Schr., Gr. and Ben.*

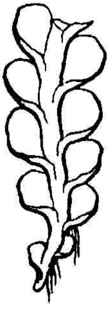
Dioicous. Shoots creeping or erect, radiculose, slightly compressed; leaves subvertical, arcuately imbricate, orbicular, concave,

upper ones retuse; amphigastria broadly subulate; involucre compressed, obovate, urceolate; capsule oval.

Jungermannia scalaris, Schrad. Crypt. II., p. 4. *Jungermannia lanceolata*, Eng. Bot. t. 605. *Nardia scalaris*, Carr. Br. Hep. p. 23; Carr. and Pears. Exs. No. 6, 7, 84; *Alicularia scalaris*, Cooke Hep. f. 27, 28.

Common on shady banks, rocks, and wet places (Fr. Spring and Autumn.)

Colour from dark brown to purple. Stolons mostly subterranean, viticulose, fleshy. Stems ½ to 1 inch in length, or longer, stout, simple, rarely forked, innovations from axils of apical amphigastria. Barren shoots of nearly equal diameter, terete or laterally compressed, curved at the summit; rootlets numerous. Leaves smaller and more distant at the base, distichous, scalately imbricate, erect, obliquely clasping, concave, orbiculate (fig. 154), submarginate, terminal leaves emarginate. Amphigastria ovate or triangular - subulate.



154.

155.

Dioicous. Fertile stems ascending, trigonous in section. Involucral leaves two or three pairs, double the size of the ordinary leaves, entire or emarginate, vaginate. Involucre obovate, lobes

roundish-ovate or cordate, sharply emarginate. Perianth immersed and adnate, apex cleft in five broad equal segments. Calyptra obovate. Capsule oval, chocolate brown, valves thick, annulate, striate. Spores dark brown, obscurely triangular, 15μ diam. Andræcium terminal on distinct shoots.

var. *a major.* Stems incrassated, naked, for the most part erect; leaves more distant, less convex, patent, and often recurved at the apex; involucral leaves emarginate; amphigastria distinct, triangularly subulate, entire. Deep green, sometimes red, or purplish.

Jungermannia scalaris, Hook. Jung. t. 61; Brit. Fl. V., 1, p. 116.

var. a major. Gott. and Rabh. Exs. No. 106, 362.

Alicularia scalaris, Corda Sturm. Fl. XIX., p. 32, t. 8; Cooke Hep. f. 27, 28.

a distans.* Stems elongated; leaves distant, more convex, erect, spreading, ventricose, dingy green, shrinking when dry.

var. *β rigidula.* Shoots rigid, creeping, subterete; leaves roundish-ovate, closely imbricate, semi-vertical; male stems terete, subspicate; amphigastria frequent, subulate; involucre half-immersed, olive green, brown, or purple.

Alicularia scalaris, a** rigidula, Gott. and Rabh. Exs. No. 223.

var. β* *rigens*. Shoots erect, slender, interrupted, two or three times innovant from the upper amphigastria; leaves adpressed, scalate, imbricate, entire; amphigastria frequent, subulate.

var. γ *compressa*. Stems short, erect, rigid; leaves orbiculate, plane, more crowded and compressed near the apex; amphigastria broadly subulate, patent; involucral bracts larger, entire, connivent, pale green.

"This species may always be distinguished from other entire-leaved Hepatics by the peculiar nucleate bodies, of two to four granules, arranged in a line, contained in the leaf-cells" (fig. 155).

Nardia geoscypha, *Not.*, *Lind.*

Autoicous. Smaller than *N. scalaris*, barren stems very slender, terete, creeping, radiculose; fertile stouter, ascending only at the apex; leaves accrescent, lower ones entire or emarginate, orbiculate; involucral leaves broader, repand-lobate; amphigastria rare on the barren stems; upper ones lanceolate, trifid; involucre immersed, seated at right angles with the stem, gibbous at its base; the cortical layer and rootlets purple.

Alicularia geoscypha, De Not. *Alicularia scalaris*, β minor, Nees Leb. Eur. I., 281; Gott. and Rabh. Exs. No. 416. *Nardia*

geoscypha, Lindberg Musc. Scan.; Carr. Br. Hep. p. 27.

On rocks, &c.

Colour reddish brown or purple, from two to six lines. Resembling *Jungermannia Genthiana* in size and colour, but differing in the immersed colesule and peculiar structure of the involucre. Dr. Carrington says that the position of the parts may be better understood if we compare the creeping shoot to the stem of a clay pipe, the head representing the involucre, and its tumid base the knob beneath.—(*Plate 5, fig. 70.*)

Nardia compressa, *Hook.*

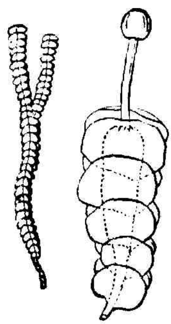
Stem erect, branched; leaves closely accumbent, bifarious, orbiculate, entire; perichætial leaves kidney-shaped; stipules on the stem none.

Jungermannia compressa, Hook. Br. Jung. t. 58; Eng. Bot. t. 2587; Lib. Crypt. Exs. No. 211. *Mesophylla compressa*, Dumort. Comm. p. 112. *Alicularia compressa*, Gott. and Rab. Exs. 443, 472; Cooke Hep. f. 9, 30. *Nardia compressa*, Carr. and Pears. Exs. No. 8, 9, 221.

Borders of mountain rills, or in the spray of waterfalls. (Fr. Spring.)

Stems ascending or erect, thread-like, flexuous, 1½ to 3 inches long, or more, of a pale brown

colour, simple or proliferous. Stolons long, branched, bearing white hair-like rootlets. Innovations numerous, from the axils of the amphigastria, or rarely from involucral bracts. Leaves smaller at the base, terminal more crowded and larger, imbricating regularly (fig. 156), erect, adpressed, plane or slightly concave, orbiculate to reniform, entire, submarginate, at right angles or oblique, dorsal margin decurrent, ventral rounded at the base (fig. 157); pale green below, or yellowish-brown, purplish or maroon in upper portion. Amphigastria ovate, subulate. Dioicous. Fertile stems thickened above. Involucral leaves terminal, two or three pairs, larger and more reniform, terminal pair compressed. Involucral amphigastria ovate, irregularly lobed. Perianth immersed, at first entire, at length quadripartite. Capsule dark brown, on short pedicel. Spores reddish-brown. Male shoots slender. Perigonial leaves terminal, enclosing two to three olive antheridia.



156. 157.

Nardia hyalina, *Lyell, Dum.*

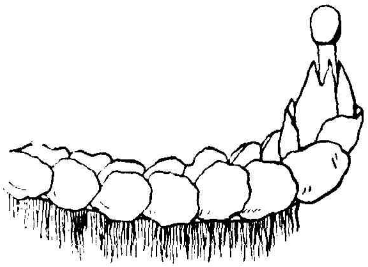
Stem creeping, almost simple; leaves erect, spreading, imbricate, rounded, somewhat undulate, entire; stipules none; perianth terminal, ovate; apex angular, mouth quadrifid.

Jungermannia hyalina, Lyell, Hook. Br. Jung. No. 63; Gott. and Rab. Exs. No. 189,

234, 469; Carr. and Pears. Exs. No. 100; Cooke Hep. f. 61. *Aplozia hyalina*, Dum. Hep. Eur. p. 58. *Nardia hyalina*, Spruce Hep. Amaz. p. 519.

On moist argillaceous rocks. (Fr. Early Sum.)

Forming more or less dense, depressed tufts, on wet slaty rocks, or mixed with bog moss. Shoots ¼ to 1 inch long, procumbent, densely rooting, simple or innovant. Branches springing from axils of the involucral leaves, or from the ventral side of the stem. Rootlets pale claret colour. Leaves semi-vertical, roundish, broad, and obliquely decurrent at the base, plane and nearly horizontal (fig. 158), except on upper part of the stem. Margin entire, a little inflexed. Texture thin, pale glaucous green. Inflorescence autoicous or dioicous. Fructification terminal. Involucral leaves larger than the rest, sometimes emarginate, closely investing the perianth. One or two amphigastria adnate with the bases of the involucral leaves, absent elsewhere; capsule globose, dark brown, shining. Spores round, yellowish-brown, 11-15μ. Elaters bispiral. Andræcium on distinct shoots, or on special branches on the ventral surface of fertile shoots. Perigonial leaves smaller. Antheridia two or three together, axillary, deep green.



158.

while the vegetative organs are the same type in both genera.

Acrobolbus Wilsoni, *Nees.*

Stem creeping, leaves obovate-quadrate, bifid, acute, lacinia, ventral, large, often unidentate.

Gymnanthe Wilsoni, Tayl. in Lehm. Fl. Nov. VIII., p. 1; Carr. Trans. Bot. Soc. Edin. VII., 452. *Acrobolbus Wilsoni*, Spruce Hep. Amaz. p. 52.

In scattered tufts on *Radula* or *Frullania.*

Stems ¼ to ½ inch long, flexuous, creeping, olive or olive-brown, adhering by scattered fascicles of short pale rootlets. Leaves approximate, roundish or obovate, divided for a third to half their length into two acute lobes, ventral somewhat larger, sinus acute, margin entire, leaves inserted obliquely. Fructification terminal. Involucral leaves originally free, much larger than the rest, broadly ovate or cordate, 2-3 lobed, with the lobes dentate. After impregnation the bases of the adjacent leaves are combined into an involucre, the lower half of which projects below the level of the stem, and forms a kind of bulb. The mouth is surmounted by the connivent involucral leaves. Perianth wanting. Capsule oval, dark, brown, on a stout pedicel, bulbous at the base. Spores minutely granular $\frac{1}{1170}$-$\frac{1}{880}$. Elaters bispiral. Male inflorescence autoicous. Antheridia one or two, oval.—(*Plate 7, fig. 83.*)

GENUS 32. **GYMNOMITRIUM,** *Corda.*

Involucre many-leaved, leaves imbricate, free, not adherent, involving the calyptra. Perianth none. Capsule four-valved, coriaceous, naked. Elaters double, naked, deciduous.—Acolea, *Dumort. Syll.* (1831).

Diocious. Perianth wanting. Involucre double, the inner shorter, composed of two or more involute, deeply cleft, dentate leaves, which enclose the short campanulate calyptra. Capsule globose, four-valved. Elaters bispiral, falling away. Antheridia oval, stipitate, in the axils of perigonial leaves. Stems fasciculate, ascending, leaves in two rows, closely imbricate, glaucous, creeping at the base, without stipules.—*Carr. Br. Hep. p. 4.*

Readily distinguished by the rigid julaceous, thickly-matted shoots, resembling a plaited thong. Colour also characteristic, silvery, creamy-white, rarely darker grey or smoky.

Gymnomitrium concinnatum, *Corda.*

Barren shoots erect, simple or fasciculately branched, slightly compressed, thicker and obtuse at the apex; leaves imbricated, ovate, bidentate, sinus and lobes acute, border narrow, membranous. Fertile shoots clavate; involucral leaves larger, with reflexed margins, upper connivent, irregularly dentate-lobate.

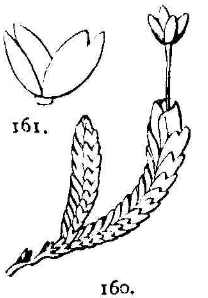
Jungermannia concinnata, Lightf. Scot. II.,

786 ; Eng. Bot. t. 2229, Ed. 2, 1820. Hook. Jung. t. iii. ; Brit. Flor. V., i., p. 110. *Gymnomitrium concinnatum*, Corda Sturm., Fl. XIX., XX., p. 23, t. 4 ; Nees Leber. I., 115 ; Carr. Brit. Hep. p. 5, t. 1, f. 2 ; Got. and Rab. Exs. No. 423 ; Carr. and Pears. Exs. No. 151, 152 ; Cooke Hep. No. 4, f. 19, 20.

Barren spongy places in Scotch mountains.

In sub-alpine northern districts of England. (Fruit, Summer.)

Growing in thick matted tufts of considerable size, of a silvery hue. Stems creeping, ascending, rooting from beneath, ½ inch long, simple, or with a few erect branches (fig. 160). Flagellæ creeping, thread-like, interwoven, brownish, naked or scaly, at length ascending and proliferous. Leaves erect, bifarious, closely imbricated, ovate, concave (fig. 161), acutely emarginate, or notched ; margin entire ; texture thin but firm, pale glaucous, silvery-olive, nearly white when old. Fértile shoots clavate. Involucral leaves, three to four pairs, larger than the ordinary ones, upper pair connivent, with two or three teeth at the apex. Inner involucre of two or three smaller leaves. Calyptra campanulate, six to eight barren pistillidia scattered



161.

160.

over the lower half. Capsule spherical, chocolate-brown, valves four, recurved when empty. Spores sphæroidal, dark tawny, 15μ diam. Male shoots more slender. Antheridia one to three together, oval, axilliary, pedunculate.

Gymnomitrium coralloides, *Nees.*

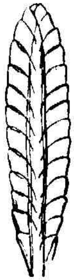
Barren shoots irregularly fasciculate, much compressed, lanceolate, subfalcate, sometimes deformed; leaves crowded, closely imbricate, roundish-ovate, retuse; margin broad, scariose, seldom entire. Fertile shoots clavate; involucral leaves obscurely emarginate; margin plane, erose-denticulate.

Gymnomitrium coralloides, Nees Europ. Leberm. I., p. 418; Gott. and Rab. Exs. Nos. 79, 383, 513; Carr. and Pears. Exs. No. 216; Carr. Brit. Hep. p. 7, t. i., fig. 4; Cooke Hep. f. 21, 22.

Rare on Scotch mountains.

Patches dark brown or nearly black, forming dense tufts. Stems ascending, rigid, irregularly branched. Fertile shoots strongly compressed, obtuse above, the remainder lanceolate. Flagellæ creeping, interlaced, dark-brown, with paler delicate rootlets. Leaves closely imbricated and brittle (fig. 162), broadly ovate, obtuse, very concave, bluntly emarginate, sometimes nearly entire, sometimes irregularly eroded or crenulate, thin, glaucous, and delicate. Dioicous. Involucral leaves closely imbricated,

outer convolute, appressed, broader than long, margin entire or eroded, *inner* two, shorter, pellucid, margin lobate-dentate, closely embracing each other. Calyptra top-shaped, of thin texture. Capsule reddish brown. Spores brown, granular. Perigonial leaves terminal on more slender stems, broadly ovate, with a hyaline ragged margin. Antheridia roundish, one or two together, on slender pedicels. Intermediate between *G. concinnatum* and *G. crenulatum*. The leaves closely pressed together, so as not to be easily detached, entirely, or almost, smooth at the edges, and with none of the cells projecting beyond the others (fig. 163).



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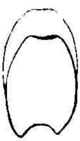


163.

Gymnomitrium crenulatum, *Gottsche.*

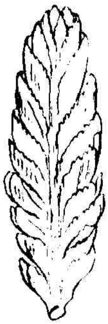
Tufts depressed, lurid brown ; barren shoots slender, rather terete, acute and arcuate ; leaves broadly ovate, complicate-concave, closely imbricate ; apex bidentate, sinus narrow, lobes acute, connivent ; margin crenulate, hyaline. Fertile shoots ovate, acute at the apex, outer involucral leaves convolute-conoid.

Gymnomitrium crenulatum, Gottsche and Rab. Exs. No. 478 ; Carr. Glean., p. 18, t. 1, f. 5 ; Carr. Brit. Hep., p. 9, t. 1, fig. 3 ; Carr. and Pears. Exs. No. 2, 3 ; Cooke Hep. figs. 17, 18.

Ireland, in sub-alpine districts, on walls and rocks, England. (*Fr.* May, June.)

Growing in flat smoky brown or olive patches, 2 to 4 inches broad. Stems densely matted. Branches ascending, of nearly equal diameter, pointed at the apex, rigid, slightly compressed. Flagellæ flexuous, attached here and there by tufts of rootlets. Leaves distichous, scarcely broader than the stem, imbricate (figs. 164, 165), ovate, acutely notched, margin narrow, crenulate. Texture thin but firm, dark olive brown. Dioicous. Involucral leaves three or four pairs, double the size of the stem leaves and less concave. The upper pair closely embracing each other. Inner involucre of two smaller leaves, with two or three dentate lobes. Calyptra obovate, reticulate. Barren pistillidia eight to twelve. Capsule buff coloured; valves punctate, striate. Spores roundish, irregular, 11-15μ diam., reddish brown. Perigonial leaves on separate shoots, shorter than the ordinary leaves. Antheridia axillary, mostly solitary, shortly pedicellate. Leaf cells minute and hexagonal, those along the margin transparent (fig. 166).

164.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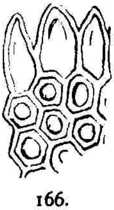

166.

Gymnomitrium obtusum, *Lind.*

Dioicous. When tufts are crowded stems

erect, $\frac{1}{4}$ to $\frac{1}{2}$ inch with branches, few assurgent, to height of chief stem; when tufts loose, stems prostrate, creeping; leaves closely clasping stem on both sides; fertile stems increasing in size to apex, which is blunt and swollen; barren shoots catenulate; leaves ovate, roundish ovate, bidentate; segments round and obtuse, finely crenulate.

Gymnomitrium obtusum, Pears. Journ. Bot., Nov. 1880; Pears. Journ. Bot., 1880, p. 337. *Gymnomitrium concinnatum*, Gott. and Rabh Exs. No. 567.

In crevices of rocks.

In tufts a few inches in diameter, or less, of a silvery polished appearance, dark coloured where exposed, and, where shaded, greenish. Stems intricately entangled, $\frac{1}{4}$ to $\frac{1}{2}$ inch, almost round, rootlets few, hyaline, produced from the underside of the stem. Leaves ovate, roundish ovate, obovate, sometimes broader at the lower half of the leaf, sometimes broader at the upper, concave, bidentate; margin entire, except occasionally at the outside of the leaf a shallow hollowing out; sinus shallow, one-fifth to one-fourth deep, sharp at the base, segments frequently slightly overlapping, widening out broadly, with the segments broad, obtuse, nearly equal, each segment very concave, forming at the top of each leaf two spoon-shaped hollows; segments finely rounded, crenulate; leaves with a hyaline border. Marginal cells quadrate, small. Male stems swollen at the

ends, where are the antheridia, perigonial leaves but little altered, more swollen at the base, and rather broader. Antheridia few, oval, on a peduncle of the same length.—(*Plate 6, fig. 78.*)

Gymnomitrium crassifolium, *Carr.*

Pulvinate, stoloniferous, branches ascending, fertile, clavate, without stipules, leaves imbricate, orbiculate, acutely emarginate, concave, segments short, acute, of thick texture, minutely papillose, margin entire. Outer involucral leaves much larger, free, cleft half way into two obtuse lobes, inner involucra shorter, three-lobed, connate, ciliate, dentate.

Gymnomitrium crassifolium, Carr. Trans. Bot. Soc., Edin. XIII., 461, t. 18, f. 3; Carr. and Pears. Exs. No. 76.

In Alpine situations.

Forming broad shallow compact tufts of a dark olive brown colour, nearly black when dry. Stems 3-5 mm. long, simple, rhizomatous, stout, decumbent at base, with tawny radicles on the underside, fertile shoots erect, subclavate. Leaves smaller at the base, of nearly equal size upwards, closely imbricate, erect, secund, embracing and hiding the stem, roundish, thick, very convex, emarginate, segments and sinus angular, margin entire, surface minutely papillose, colour dull olive brown, subopaque. Dioicous. Male shoots erect, terete, apex obtuse. Perigonial leaves somewhat broader, tumid at the base,

closely imbricated. Antheridia numerous, oval, solitary in the axils of the leaves. Fertile shoots stouter, clavate, erect. Outer involucral leaves occupying one-third of the shoot, subquadrate, free from the inner, cleft half way into obtuse pointed lobes, sinus narrow, reflexed, lobes entire. Inner involucral leaves connate for two-thirds, trilobate segments irregularly dentate, one-third shorter than outer leaves. Calyptra campanulate. Capsule sphærical, cinnamon brown, pedicel stout, one line long. Spores irregularly round, 12-15μ. Elaters bispiral, narrowly fusiform.—(*Plate 7, fig. 84.*)

From *G. concinnatum* and *G. coralloides* known by its smaller size, absence of the creamy glaucous colour, and the scariose margins of the leaves in those species.

Sub-tribe VII. FOSSOMBRONIEÆ.

Plants foliose, or often frondose. Male flowers longitudinally marginal; antheridia two to five.

GENUS 33. **SCALIA,** *Gray.*

Involucre two-leaved, opposite, conforming with the stem leaves; perianth none; calyptra free, naked, exserted, elongated, cylindrical, longer than the perichætium; capsule four-valved; coriaceous, valves straight, bearing elaters at the apex; elaters bispiral, persistent.—*Gray Arr. Br. Pl., p.* 705. *Spruce Hep. Amaz., p.* 531.

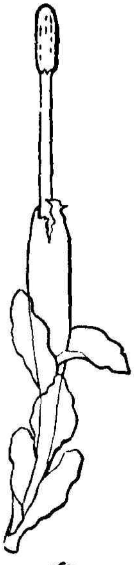
Mniopsis, Dumort. Hep. Eur., p. 120, t. 3, f. 36.

Scalia Hookeri, *Lyell.*

Stems erect and seldom branched; rather long and irregularly-shaped leaves springing from all sides of the stem. There is no calyx, and the hood is fleshy and prominent.

Jungermannia Hookeri, Lyell. Eng. Bot. t. 2555; Hook. Brit. Jung. t. 54; Sm. Br. Fl. V., p. 1, 107. *Haplomitrium Hookeri*, Nees Leberm. III., 513; Cooke Hep. f. 14. *Scalius Hookeri*, Carr. Br. Hep. p. 2, t. 1, f. 1.

Heaths and damp places. (Fr. Winter and Spring.)



167.

Grows in small and scattered patches of a dull green colour. Creeping at the base, rooting shoots divaricate. Stems erect up to ½ inch long, simple, rarely forked, succulent. Leaves pale green, distant, loosely imbricate, near the base smaller, and roundish-ovate, upper ovate-oblong, or tongue-like, obtuse, repand, or jagged and toothed, sometimes entire, spreading (fig. 167) obliquely decurrent. Amphigastria or stipules smaller, but similar. Texture soft, shrinking when dry. Involucral leaves resembling those of the

stem, but larger, at first connivent, then reflexed. Perianth absent. Calyptra linear oblong. Pedicel 1 inch long. Capsule pale brown, opening by two or four valves, frequently held together by the elaters. Spores roundish or angular, reticulate, reddish brown. Antheridia globose, golden yellow, five or six together in the axils of the upper leaves of the male plant.

GENUS 34. FOSSOMBRONIA, *Raddi.*

Involucre scale-like, more or less coalescing with the colesule. Perianth campanulate, lobed, mouth funnel-shaped. Capsule univalvular, globose, with four teeth, dehiscing irregularly. Elaters geminate, naked, deciduous. Plants small, mostly destitute of a true stem.—*Jung. Etrusc.* (1820), p. 40.

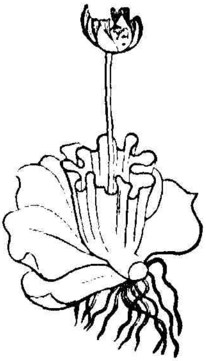
Fossombronia pusilla, *L.*, *Dum.*

Either detached or in tufts or patches. Stems prostrate, unbranched. Leaves closely set in two opposite rows, squarish, crisp or waved, extremity notched. Perianth large, campanulate, border lobed and waved.

Jungermannia pusilla, Linn. Sp. 1603; Hook. Br. Jung. t. 69; Eng. Bot. t. 1775. *Fossombronia pusilla,* Dum. Rev. Jung. p. 11; Gott. and Rab. Exs. No. 8, 122, 488; Cooke Hep. f. 164.

Moist banks. (Fr. Aut. Spr.)

Growing detached, or thickly matted in patches of many inches. Stems procumbent, flat, one to three or four lines long, cylindrical or compressed, simple, or more rarely once or twice dichotomous. Leaves closely placed, obliquely decurrent, horizontal, rather square, waved, cut into two, three, or four obtuse notches at the apex, forming blunt segments, pale green. Calyx singly or two to three together, large, campanulate, with a cleft at the margin, the border crenate and waved (fig. 168), five minute stipulate processes at the base. Sometimes the calyx is cut into three or four unequal segments. Calyptra spherical, white. Capsule spherical, reddish brown, thin and delicate, bursting irregularly.



168.

Elaters of two or more spirals. Spores round, with elevated parallel or radiating ribs, rarely anastomosing, 40-45μ diam.

Fossombronia cæspitiformis, *De Not.*

Stem simple, very short; leaves undulate, apex angularly toothed. Perianth terminal, plicately waved, rather denticulate. Spores spinulose.

Lichenastrum pinnulis, &c., Dill. Musc. 493,

t. 71, f. 22 E. *Fossombronia cæspitiformis*, De Not in Gott. and Rab. Exs. No. 123, 439; Carr. and Pears. Exs. No. 53, 54.

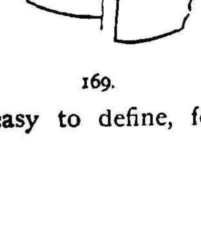
On moist ground.

In some respects similar to *F. angulosa*, of which it formerly stood as a variety, but with a very short stem, the leaves in the upper portion crowning the stem with a crispate rosette. Elaters long, with two, rarely three, spirals. Spores dark brown, round, studded with elongated obtuse warts, 45-50μ.

Fossombronia angulosa, *Raddi*.

Stem simple, elongated; leaves nearly quadrate, with the angular apex crenate; perianth lateral, plicately waved, rather denticulate; spores coarsely reticulate; elaters with two to three spirals.

Lichenastrum pinnulis, &c., Dill. Musc. 493, t. 71, fig. 22, C. D. *Fossombronia angulosa*, Raddi. Jung. Etr. 40, t. 5, f. 4; Gott. and Rab. Exs. No. 444, 471; Cooke Hep. f. 165; Carr. and Pears. Exs. 55, 56, 199.



169.

On clay soil, moist ditches, &c.—(*Plate 7, fig. 86.*)

"This is a much finer plant than *F. pusilla*, although not easy to define, forming wide shallow patches,

branched dichotomously, of a delicate translucent green, the stem broad and purple, clothed with radicles of the same colour. The leaves are a line or more broad, obtusely lobed, horizontal; calyx campanulate, crenate" (fig. 169).—*Carrington.*

Although Dr. Carrington describes the spores as "covered with short spines," M. Corbiere has shown that the surface of the spore is alveolate, with deep hexagonal pits, 35-38μ diam.—(*Revue Bryol., 1890, p. 2.*)

GENUS 35. **PETALOPHYLLUM,** *Gottsche.*

Involucre connate with the colesule. Perianth quadrate-campanulate, mouth funnel-shaped, undulate, toothed. Capsule coriaceous, one-valved, split to the middle into four irregular segments, pitted, lobed at the apex. Elaters vague, geminate, deciduous.—*Codonia* Dumort. Comm. Bot. p. 111 (1822).

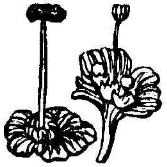
Petalophyllum Ralfsii, *Gottsche.*

Fronds procumbent, the midrib prominent beneath, overlapping each other in a singular lamellate manner (figs. 166, 167). Fruit borne from the upper surface. Calyx funnel-shaped, broad and toothed. Calyptra shorter. Capsule spherical, bursting irregularly. Spores reticulated.

Jungermannia hibernica, var. Wils. Eng.

Bot. t. 2750, figs. 15, 16. *Jungermannia Ralfsii*, Wils. Eng. Bot. Supp., t. 2874, t. 2750, figs. 15, 16. *Petalophyllum Ralfsii*, Gottsche Syn. Hep., p. 472; Gott. and Rab. Exs. No. 448; Carr. and Pears. Exs. No. 214; Cooke Hep. f. 166, 167. *Codonia Ralfsii*, Dumort. Hep. Eur. p. 16, t. 1, f. 2.

Dioicous. Growing close to the ground, with spreading, obovate, forked divisions, sometimes simply obovate, flattish, beset on the upper side with erect lamellar processes, disposed in radii towards the extremity of the frond, which is somewhat emarginate, colour light green, texture rather flaccid, except the thick midrib which is often lengthened out at the base of the frond,



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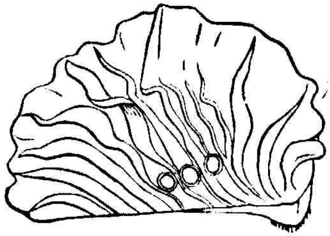


171.

and denuded so as to resemble a stipe. Midrib covered beneath with fibrous radicles. Perianth widening at the mouth, broad in proportion to its length, the sides ribbed or lamellate. Calyptra concealed. Capsule round, olive brown, opening irregularly. Elaters bispiral (figs. 170, 171).

GENUS 36. PELLIA, *Raddi.*

Involucre cup-shaped, mouth torn into teeth. Perianth none. Calyptra four-valved, valves naked, rounded. Elaters central, persistent, double, enclosed.—*Raddi. Jung. Etrus. p.* 49 (1820).

Plants frondose, without leaves, fronds without ribs.

Pellia epiphylla, *Linn.*

Frond oblong, sinuate, lobate, thick ; involucre included ; calyptra exserted. Fruit produced from the upper surface of the nerve near the extremity.

Jungermannia epiphylla, Linn. Sp. 1602 ; Hook. Br. Jung. t. 47. *Pellia epiphylla*, Corda Opiz. 654 ; Dumort. Hep. Eur. 145 ; Gott. and Rabh. Exs. 31, 119, 120, 179, 274, 357 ; Cooke Hep. f. 171 ; Carr. and Pears. Exs. 200, 201, 202, 203.

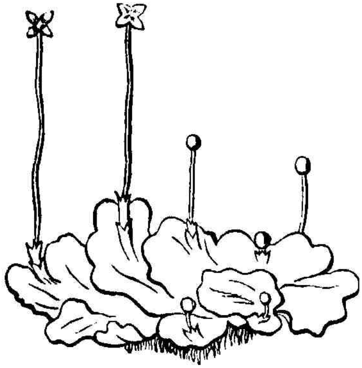
var. β *endiviæfolia* Dicks. Fronds elongate, broadly linear, fruit terminal and lateral.

Jungermannia endiviæfolia, Dicks. Crypt. IV., p. 19.

In shady wet places. (Fr. Aut. and Spr.)

Growing generally in large patches, some feet

broad. Fronds 1 or 2 to 4 inches long, oblong, narrowest at base, simple or once or twice divided irregularly, by short lateral segments, margin waved, entire, or only cut into a few short unequal lobes, which are flat or curved, sometimes innovant. The whole plant has a wide and conspicuous nerve. Colour deep green.



172.

Calyx bursting through the frond, tubular, somewhat plicate, mouth a little expanded, and irregularly toothed. Calyptra ovate, becoming oblong, in length twice or thrice exceeding the calyx. Capsule pale greyish brown, four-valved. Elaters bispiral, attached to the inner base of the capsule in tufts (fig 172).

Pellia calycina, *Mack.*

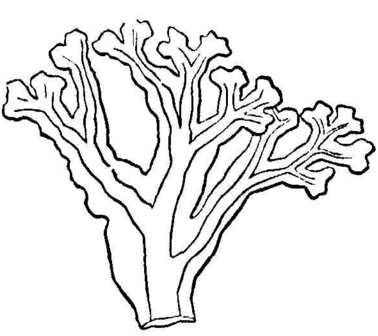
Dichotomous, segments elongated, broadly linear, palmatifid, rib stout, distinct; involucre exserted, cup-shaped, calyptra included.

Jungermannia epiphylla var. γ *furcigera*, Hook. Br. Jung. t. 47, f. 18. *Jungermannia calycina*, Mack Hib. II., 55; Eng. Bot. Suppl.

t. 2873. *Pellia calycina*, Nees Eur. Leb. III., 386; Gott. and Rabh. Exs. 181, 242, 297, 339; Cooke Hep. fig. 172; Carr. and Pears. Ex. No. 142, *a*, *b*.

On shady wet banks. (Fr. Feb. Mar.)

Considerable resemblance exists between this species and *P. epiphylla*, but it differs in the shape of the frond, which is much narrower, more elongated, with more numerous subdivisions (in the male fronds linear); margins more flexible, wavy, and sometimes crisped; midrib better defined at the edge; the colour of the mature fronds a darker green, destitute of the brownish purple tinge on the midrib. Dioicous. Males immersed in the frond, above the midrib. The large ventricose perianth, and the short included, and concealed, calyptra is constant (fig. 173).



173.

GENUS 37. **PALLAVICINIA**, *Gray*.

Frond simple or bifid, with a distinct median costa, radiculose beneath, antheridia solitary, uniseriate at the margin of the

midrib. Involucre monophyllous, torn, at first terminal from the costa. Perianth tubular, mouth denticulate. Calyptra chartaceous, equal or shorter than the perianth, torn at the apex. Capsule four-valved. Elaters bispiral, deciduous. Spores minute.—Gray Arr. Br. Pl. (1821); Spruce Hep. Amaz. p. 536.

Pallavicinia Lyellii, *Lindb.*

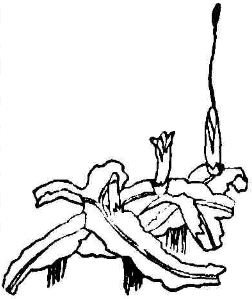
Frond procumbent, rather branching. Involucre fimbriate. Perianth cylindrical, scarce touching the calyptra.

Jungermannia Lyellii, Hook. Br. Jung. t. 77; *Dilæna Lyellii*, Dumort. Hep. Eur. p. 137; *Blyttia Lyellii*, Lind. G. and N. Syn. Hep. p. 475; Gott. and Rabh. Exs. No. 121; Carr. and Pears. Exs. No. 144; Cooke Hep. fig. 168. *Pallavicinia Lyellii*, Spruce Hep. Amaz. p. 537.

In bogs. (Fr. May.)

Growing in small matted patches. Frond about 1 inch long, or twice that length, horizontally pressed to the ground, or matrix, oblong, nearly linear, simple, or shortly branched laterally, or forked at the extremity (fig. 174); margin waved, frequently entire, now and then with a few distant unequal teeth, a distinct nerve running down the centre, rather prominent on both sides, of a pale green colour. Innovations not unfrequent, from

the underside of the nerve, sometimes simple and sometimes branched, which at length detach themselves and become new plants. Perigonial scales numerous on each side the nerve, ovate, and toothed. Calyx double, the exterior shortest, laciniate at the margin, the interior more delicate, three or four times as long as the outer, a little plicate and toothed at the mouth, torn on one side. Capsule oblong-ovate, pale brown. Elaters bispiral.



174.

Pallavicinia hibernica, *Hook.*

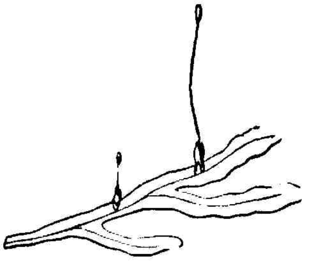
Frond procumbent, dichotomous, perichætium urn-shaped (urceolate), torn, dentate, perianth oblong-ovate, twice as long as the calyptra.

Jungermannia hibernica, Hook. Br. Jung., t. 78, Supp. t. 4. *Dilæna hibernica*, Dumort. Hep. Eur. 137. *Mœrckia hibernica*, Gott. and Rab. Exs. 295, 163, 334, 335 ; Carr. Trans. Bot. Soc. Edin. VII., p. 443 ; Cooke Hep. figs. 169, 170. *Pallavicinia hibernica*, Carr. and Pears. Exs. No. 143.

Growing amongst Sphagnum. (Fr. April.)

In small imbricated patches, from 2 to 4

inches long, procumbent, oblong, once, twice, or thrice branched dichotomously, branches spreading, the whole plant more or less waved and undulated, especially at the margins, which are quite entire (fig. 175). Substance delicate, nerve scarcely differing except in thickness from the rest of the frond. Colour pale green. Perigonial scales few on the nerve, closely adpressed, ovate, convex, margins slightly toothed. Calyx double, exterior one short, cut nearly to the base in lanceolate laciniæ, which



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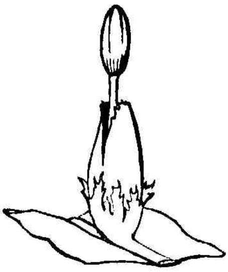


176.

are themselves toothed. Interior more delicate, paler, three times as long, nearly cylindrical, cut down on one side, slightly toothed (fig. 176). Capsule oblong-ovate. Elaters bispiral.

As to the differences between this and *Blyttia Lyellii*, Gottsche remarks that the former "has no nerve, the latter has a nerve. In the former all the cells are alike, and no midrib with ligneous fibres is present."

Genus 38. BLASIA, *Mich.*

Involucre undivided, bladdery, adnate to

the apex of the frond ; peduncle emerging from the apex. Perianth internal. Capsule four - valved, coriaceous, naked. Elaters double, naked, deciduous.

Plants without leaves, frondose, the fronds having nerves.

Blasia pusilla, *Linn.*

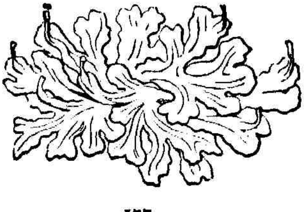
Utricular involucre immersed, adnate to the frond ; elaters double, free.

Form β *capsulifera,* Hubn.

Jungermannia blasia, Hook. Br. Jung., t. 82, 84. *Blasia pusilla,* Linn. Sp. 1605 ; Carr. and Pears. Exs. No. 145, 146, 287 ; Cooke Hep fig. 173.

On the margin of ditches. (Fr. Mar. Apr.)

Growing in patches, often imbricating. Radicles more or less numerous, and on different parts, frequently along the underside of the nerve. Frond horizontal, prostrate, the apices often erect, ¼ to 1 inch long, for the most part oblong, sometimes simple, or with a single lateral branch, but sometimes more divided dichotomously; at other times the ramification is almost palmate, having the ends forked, extremities always wider than the base, more rarely the fronds are stellate, substance



177.

between fleshy and membranaceous, thinnest at the margin, which is waved and obtusely lobed, the lobes often incurved (fig. 177). Throughout the centre of the frond, and its divisions, runs an evident and broad nerve, most prominent on the underside, whole plant pale green. Closely adpressed to the nerve on the underside are scattered small, oval scales resembling stipules, which are unequally dentate. Calyx oblong-lanceolate, and acuminate, inflated, semi-transparent. Capsule ovately globose, whitish at the base, the rest pale olive brown. Elaters bi-spiral.

Sect. B.—Elaters monospiral, acute at each extremity.

Sub-tribe VIII. METZGERIEÆ.

Plants frondose, pinnately or dichotomously branched ; laciniæ linear ; reproductive organs of either sex in two rows on the costa in abbreviated branches ; pistillidia two to twenty, without styles. Perianth none. Calyptra large, clavate, fleshy, papillose, or hairy. Capsule four-valved. Elaters fixed, mixed with others free, rising in four tufts on the open capsule ; monospiral, attenuated to each end.

GENUS 39. **METZGERIA,** *Raddi.*

Involucre scale-like, of one leaf, bilobate. Perianth none. Calyptra exserted, echinate.

Capsule four-valved, coriaceous, valves bearing elaters at their apex. Elaters terminal, solitary, naked, persistent.—*Raddi. Jung. Etrusc., p.* 45, 1820.

Plants without leaves, frondose, fronds costate.

Metzgeria furcata, *Linn.*

Frond creeping, linear, dichotomous, margin ciliate, nerve villose.

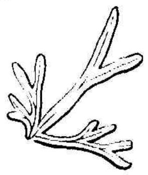
Jungermannia furcata, Linn. Sp. 1602; Hook. Br. Jung. t. 55, 56; Eng. Bot. t. 1632. *Metzgeria furcata,* Dum. Rev. Jung. p. 26; Gott. and Rab. Exs. No. 31, 119, 120, 179, 274, 357; Carr. and Pears. Exs. 72, 73; Cooke Hep. figs. 179, 180, 181, 182.

On trunks and on the ground. (Fr. Spring.)

var. γ *æruginosa, Hook.* Fronds broader, dilated at the apex, quite obtuse.—*Jung. fruticulosa,* Eng. Bot. t. 2514.

Growing in dense patches, closely pressed to the surface. Fronds ½ to 1 inch long, creeping, horizontal, overlying each other in an imbricated manner, linear, thin, membranaceous, slightly waved, margins entire, always branched in a furcate manner, with the branches forked for the most part at the extremity, apices obtuse, upper surface smooth, margin and under surface beset with stout white hairs. Colour pale and pleasant green. Throughout the frond and its branches runs a distinct central

nerve (fig. 180), which gives rise to innovations beneath, which at length separate, and become distinct individuals. Calyx at first scale-like, roundish, adpressed, convex, fringed with white hairs; then cut into two reniform lobes, embracing the base of



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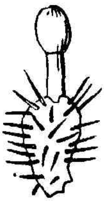

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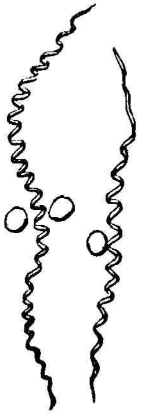

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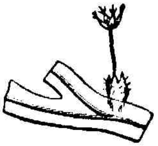


181.

the calyptra, then exserted. Calyptra obovate, curved at the base, erect, beset on every side with whitish hairs, which are rigid and bristling (fig. 178). Capsule deep brown, with four valves which soon become twisted. Elaters simple (fig. 179).

Metzgeria pubescens, *Raddi.*

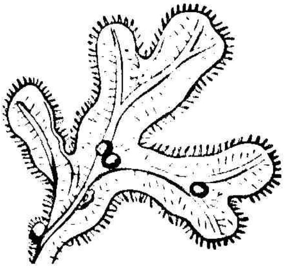
Frond creeping, branched, furcate, linear, everywhere pubescent.

Jungermannia pubescens, Schrank Sal.

p. 231 ; Hook. Br. Jung. t. 73. *Metzgeria pubescens*, Raddi. Jung. Etr. p. 46 ; Gott. and Rabh. Exs. No. 84 ; Carr. and Pears. Exs. No. 149, 150 ; Cooke Hep. fig. 183.

On wet rocks.

Forming glaucous green patches. Fronds 1½ inch long, horizontally creeping, and imbricating. Branched in a dichotomous manner once or twice, apices always obtuse, edges waved, but entire, centre furnished with a strong nerve, the whole surface above and below, and the margin, covered with short, white simple hairs. Colour pale green, glaucous with the white hairs (fig. 182).



182.

Metzgeria hamata, *Lind.*

Dioicous, very often large and much elongated, dichotomous ; branches long-linear, and equally broad throughout, very convex, subterete, not undulate, postical in the stem, and margins densely setosely pilose, hairs very long, divaricate, those on the margin torn and divergent.

Metzgeria hamata, Lind. in Mon. Metz. fig.; G. and Rabh. Exs. 559 ; Carr. and Pears.

Exs. 206, 207. *Metzgeria linearis*, Moore Irish Hepat. 666.

In moist situations.

Plants 10 c.m. long, 2½ mm. broad, pallid, yellowish, greenish, or lurid yellow, shining when dry, very pellucid, dichotomous, linear, obtuse at the apex (*plate 7, fig. 88*), margins much reflexed, nearly meeting, so as to make the stems appear half-round when dry, subelliptic in transverse section, hairs very long, in twos or threes together, spreading widely, and arcuately bent.

This appears to be the *M. furcata* β *elongata* of Hooker's Jungermanniæ, pl. 56, fig. 2.

Metzgeria conjugata, *Lind.*

Autoicous, robust, rather elongated, more or less dichotomous, or irregularly pinnate, or decompound, linear, but narrower in some parts than in others; antically convex, in transverse section more or less semi-lunar; hairs longish, singly, or often in pairs on the margin, and divergent.

Metzgeria conjugata (Dill.), Lindb. Hedw. 1876, p. 11; Dill. Musc., t. 74, f. 45, D.E.; Gott. and Rahb. Exs. 119, 274*b*, Carr. and Pears. Exs. 205; Lind. Mont. Metz. fig. 6.

On bark.—(*Plate 7, fig. 89.*)

The paucity of hairs and more horny substance of the stems distinguish this from any of the normal

states of *M. furcata*, but the chief distinguishing character seems to be the autoicous inflorescence, which is remarkable in a genus where all the other species are dioicous.

GENUS 40. ANEURA, *Dumort.*

Involucre cup-shaped, shortened; perianth none; calyptra exserted, smooth, naked; capsule four-valved, coriaceous, valves bearing elaters at the apex; elaters terminal, double, naked, densely spiral, persistent.

* Plants without leaves, frondose, fronds continuous, without costæ.

A. Phymatia. Calyptra tuberculate; perichætium submarginal.

Aneura multifida, *Linn.*

Frond rosulate, documbent, bipinnatifid, lobes dilated at the apex, horizontal, pinnatisect; involucre very short, mouth fimbriate; calyptra clavate, tuberculate.

Jungermannia multifida, Linn. Sp. 1602; Eng. Bot. t. 186; Hook. Br. Jung. t. 45. *Aneura multifida*, Dumort. Comm. 115; Gott. and Rab. Exs. 463; Cooke Hep. f. 176, 177. *Riccardia multifida*, Carr. and Pears. Exs. No. 62.

In wet places on heaths, &c.

var. α *major*, Nees.

On rocks in streams.

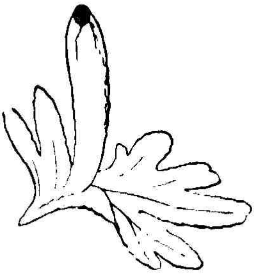
var. β *ambrosioides*, Nees. *Riccardia multifida* v. *ambrosioides*, Carr. and Pears. Ex. No. 63.

Running among wet moss.

var. γ *filiformis*, Nees.

Growing in loose balls in boggy places.

Generally growing in thickly-crowded tufts. Fronds ½ to 1½ inch long, half to three-quarters line broad, compressed, erect or decumbent, always branched, but variously (fig 183), often twice or thrice divided irregularly, with narrow laciniæ, at other times pinnate or bipinnate, pinnæ distant, alternate, spreading or horizontal, beset with remote pinnules, obtuse at the apex, rarely emarginate, fleshy, succulent, pale green. Calyx short, slightly attenuate at the base, mouth expanded and laciniate. Calyptra oblong, widening gradually to the apex, yellowish white. Capsule oblong, brown, striate. Elaters simple, attached at the apices of the valves.



183.

Aneura pinnatifida, *Nees.*

Frond procumbent, linear, pinnatifid,

branches horizontal, broader at the apex, pinnatifid or dentate, obtuse ; perichætium campanulate, mouth laciniate; calyptra cylindrical, even, downy.

Jungermannia pinnatifida, Nees in Mart. Fl. Bras. p. 327. *Ancura pinnatifida*, Dumort. Rev. Jung. p. 26 ; Cooke Hep. f. 175.

var. *sinuata*, Dicks. Crypt. II., p. 16 ; Eng. Bot. t. 1476. Rather more branched, digitate-palmate.

Jungermannia multifida β sinuata, Hook. Br. Jung. t. 45. *Aneura sinuata*, Dumort. Comm. p. 115. *Riccardia sinuata*, Carr. and Pears. Exs. No. 60, 61.

Near waterfalls and mountain streams.

It is recorded of the form *sinuata* that the fronds are larger and flatter than in *A. multifida*, as well as somewhat more compound, with unequally cloven extremities, while the fructification is smaller and more scattered.—(*Plate 7, fig. 90.*)

Aneura palmata, *Hedw.*

Frond rosulate, ascending, digitate-palmate ; segments linear, unequal; perichætium median; calyptra clavate, tuberculate.

Jungermannia palmata, Hedw. Theor. t. 20, f. 3-7, t. 21, f. 1-3. *Aneura palmata*, Dumort. Comm. 115 ; Gott. and Rab. Exs. No. 43, 463.

Riccardia palmata, Carr. and Pears. Exs. No 204.

var. *polyblasta*, Nees.

On dead trees.

var. γ (?) *conferta*, Nees.

On dead trees.

Dioicous, small, opaque. Fronds with a short and narrow stipe, divided into narrow linear palmate segments, very often gradually narrowed towards the apex, and rather acute, scarcely emarginate, biconvex, gonidia produced on both surfaces, but almost always on the superior parts. Cells small, rounded, perichætial bracts numerous, Calyptra small and densely warted. Andræcium linear.—(*Plate 7, fig. 91.*)

Aneura latifrons, *Lindb.*

Autoicious, rarely paroicous, large, pellucid. Frond long and broad, divided into broad staghorn-like lobes, more or less oblong, wedge-shaped, very obtuse and emarginate, plano-convex. Cells large, oblong-rhomboid; perichætial bracts few; calyptra large and less verrucose. Andræcium narrow, oblong, almost always affixed to the side of the perichætium.

Aneura palmata major, Nees Hep. Eur. III., 459. *Riccardia palmata*, Carr. in Seem. Journ. III., 302; Hook. Brit. Jung. t. 45, fig. 4, 7 and 12. *Riccardia latifrons*, Lind. Not. Soc.

Fl. Fenn. 13, p. 372; Gott. and Rahb. Exs. 202, 493. *Aneura latifrons*, Carr. and Pears. Exs. 288, 289.

On the naked ground.—(*Fig. 184.*)

This has often been confounded with *Aneura palmata*, but the fronds have divided lobes, branch-

184.

ing in a "stag-horn," manner, and not palmately lobed as in that species.

B. Aneurotypus. Calyptra even; perichætium intermarginal.

Aneura pinguis, *Linn.*

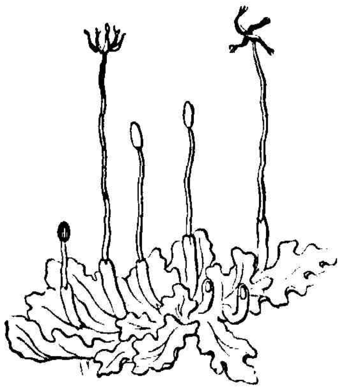
Frond decumbent, oblong, sinuately lobate, without nerves; calyptra cylindrical, even.

Jungermannia pinguis, Linn. Sp. p. 1602; Eng. Bot. t. 185; Hook. Br. Jung. t. 46. *Aneura pinguis*, Dumort. Comm., 115; Gott. and Rabh. Exs. 41, 103, 436, 427; Cooke

Hep. f. 174. *Riccardia pinguis,* Carr. and Pears. Exs. No. 59.

In most places on marshes.

Growing in loose and straggling patches. Fronds 1 to 2 or 3 inches long, sometimes nearly erect, oblong, narrowest at the base, thence gradually widening to the apex, which is rounded and obtuse, either simple, or with one or two large divisions or segments, and other smaller ones, plane or a little concave, and swollen (fig. 185); substance fleshy and succulent, opaque, yellowish green. Calyx nearly hemispherical, with an expanded mouth and fimbriate margin. Calyptra linear oblong, cylindrical, straight, curved at the base, obtuse. Capsule oblong, red-brown, striate or furrowed, four-valved. Elaters simple, attenuated to each end.



185.

Sub-order 2. *MARCHANTIÁCEÆ.*

Frondose, prostrate, areolate above, the areoli uniporose, amongst the radicles beneath, furnished with coloured seriate scales. An-

dræcium either peltate and stipitate, or discoid and subimmersed. Female capitulum on a stout peduncle, continuous with the rib of the fronds; two or many flowered. Capsule with a short stem, globose, unistratose, circumscissile, or split four to eight times at the apex.

GENUS 41. MARCHANTIA, *Mich.*

Fronds mostly fleshy; scales beneath on each side 4-5 seriate, peduncle two, rarely three, channelled. Capitulum many-lobed, radiating. Involucre two to five flowered. Perianth three to five cut. Capsule stipitate. Apex cut in four to eight segments. Andræcium on long peduncle (fig. 194).

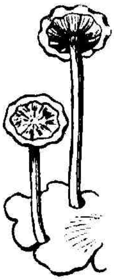
Marchantia polymorpha, *Linn.*

Fronds prostrate, overlapping, generally once or twice forked, 1 to 4 inches long, of a dull-green colour; male receptacle stalked, flat on the top, cut into eight short, rounded lobes. Female receptacle stalked, hemispherical, deeply divided into eight to ten rays, covering as many involucres.

Marchantia polymorpha, Nees Hep. Eur. IV., 61; Tayl. Linn. Trans. XVII., 376; Eng. Bot. t. 110; Hook. Br. Fl. V., 102; Cooke Hep. fig. 186; Carr. and Pears. Exs. 147.

In moist and wet situations. (Fr. July.)

Fronds much imbricated, procumbent, only erect when growing in water, variable in size, rarely simple, usually once or twice dichotomous, 1 to 4 or 5 inches long ; laciniæ mostly short, prominent dark midrib beneath, whence spring numerous silky radicles. Colour uniform dull green, between fleshy and membranaceous. Dioicous. Male receptacle greenish, pedunculate, springing from the base of a sinus, at the end of a frond (fig. 186). Receptacle, flat on the top, horizontal, papillose, fleshy, thin at the margin, cut into about eight short rounded lobes. Anthers equal in number to the papillæ on the surface, and imbedded in it, opening by an orifice through the papillæ. On the underside numerous imbricated scales, radiating so as to correspond with the marginal lobe. Female receptacle pedunculate, hemipherical, deeply divided to the base into eight to ten linear decurved rays, covering as many involucres (fig. 187), which are united at the base, and mixed with minute chaffy scales. Involucres oblong, open at the end and torn, enclosing an ovate quadrifid perianth. Calyptra obovate. Capsule ovate, pale greenish brown, protruded a little beyond the calyx, opening into about eight short segments. Elaters bispiral. Gemmæ pro-



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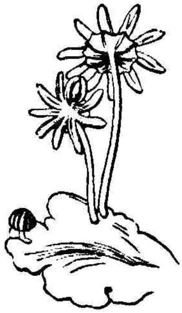


187.

duced in cup-shaped processes on the surface of the frond, and on the midrib.

GENUS 42. LUNULARIA. *Mich.*

Male receptacle sessile. Margin membranous, elevated. Female receptacle divided into cells, the apex of which open by a longitudinal fissure. Calyx none. Capsule quadrivalvular, exserted.

Lunularia vulgaris. *Mich.*

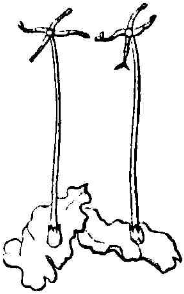
Fronds densely clustered, 1 to 2 inches in length, of a light shining green, divided into three or four lobes with the margins waved. Male receptacle sessile. Female receptacle stalked, with four linear lobes. Capsules elongated, blackish, opening with four valves.

Marchantia lævis, Hook. Eng. Fl. V., p. 103. *Lunularia vulgaris*, Mich. Nov. Gen. t. 4; Tayl. Linn. Trans. XVII., 308; Cooke Hep. f. 185; Carr. and Pears. Exs. No. 148.

On road-sides or banks.

Dioicous. Frond furcate, innovant at the apex, radiculose beneath from the effused median costa. Dorsal epidermis distinctly areolate and porose, walls of the cells thick. Apex of the common peduncle incrassated, involucrate at the base, membranaceous involucre polyphyllous. Partial invo-

lucre at the apex of the peduncle, quaternate, cruciate, spreading horizontally (fig. 188), apex vertically bilabiate, monocarpus. Perianth none. Calyptra included, crowned with a style, splitting above, pedicels the length of the involucre. Capsule exerted, thin, four to eight valved, valves spreading, somewhat twisted. Elaters bispiral, deciduous. Pistillidia four to six, in discoid receptacle, sessile, superficial, girt by paraphyses. Male receptacle oblong, at the sinus of the frond, sessile on the upper surface, girt by an elevated margin.—(*Plate 7, fig. 93.*)



188.

GENUS 43. PREISSIA, *Nees.*

Female receptacle pedunculate, hemispherical, four-lobed, rays of the lobes shorter, rib-like. Perianth obconically campanulate, angular, unequally four or five parted. Calyptra persistent. Capsule shortly pedicellate, cut into four or eight irregular valves. Elaters bispiral. Male receptacle pedunculate, peltate, repand, lobate. Margin thin. Fronds sparsely forked, bearing the peduncle from a sinus of the terminal lobe.

Preissia commutata, *N.*

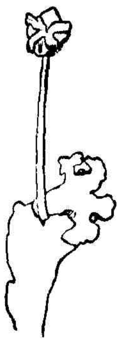
Male receptacle peltate, pedunculate; fe-

male receptacles stalked, often with four indistinct angles, marked on the top with a cruciate crest; frond obcordate, innovant from the sinus.

Marchantia commutata, Linden. Hep. Eur. [illegible] *Marchantia hemisphærica*, Hook. Br. Fl. V., 104. *Marchantia androgyna*, Eng. Bot. t. 2545. *Preissia commutata*, Nees Hep. Eur. p. 117; Cooke, Hep. f. 188; Carr. and Pears. Exs. 208, 209.

Side of mountain streams.

Fronds procumbent, imbricated, oblong, 1 to 3 inches, generally forked, rarely simple, waved and crenate at the margin, dark green above, frequently with a dark central line indicating the midrib, underside often purple at the margin, midrib prominent, with numerous silky radicles, beset on each side with purple scales. Monoicous or dioicous. Male receptacle with short pedicels springing from the midrib in a sinus at the end of the frond, receptacle peltate, flat and papillose above, purplish, margins reflexed, cut into four or eight rounded lobes. Female receptacle with pedicels 2 to 4 inches long, hemispherical, cut at the margin into from four to ten or eleven obtuse deflexed lobes, covering as many involucres, which have entire margins. Calyx white, quadrifid, two to three in each involucre. Capsule scarcely protruded when mature on a


189.

very short peduncle, cut half way down into seven or eight obtuse revolute segments. Elaters bispiral. The receptacle is marked on the top with a cruciate crest, which is obtusely four-lobed (fig. 189).

GENUS 44. REBOULIA, *Nees.*

Female receptacle pedunculate, conical, hemispherical or plane, 1 - 6 lobed; lobes parted nearly to the middle; peduncle continuous with the frond, involucrate at the base, bearded at the apex. Perianth none. Calyptra oval, then saucer-like at the base of the fruit, or obsolete. Capsule hidden by the valves of the involucre, subglobose, irregularly torn at the vertex or suboperculate, very shortly pedicellate; pedicel immersed in the receptacle. Elaters bispiral. Male receptacle sessile, discoid. Vegetation frondose.

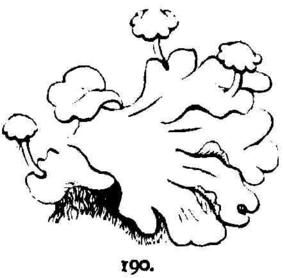
Reboulia hemisphærica, *Raddi.*

Fronds prostrate, flat, overlapping, generally forked, and waved at the margin, of a dark green colour. Midrib prominent. Receptacle cut at the margin into from four to ten equal lobes, covering as many involucres, which are *not* toothed. Easily distinguished by the deeply divided 4-5-fid receptacle, which is barbate beneath and at the base of the peduncle.

Fegatella hemispherica, Tayl. Linn. Trans. XVII., p. 383, t. 12, f. 4. *Reboulia hemisphaerica*, Raddi. Opus. Sci. Bot. II., 357. *Marchantia hemispherica*, Eng. Bot. t. 503.

Sides of mountain streams and moist banks. (Fr. April.) (*Fig. 190.*)

Fronds 1 to 2 inches, dichotomous and variously lobed and sinuate, spreading and creeping by means of numerous slender radicles descending from the prominent midrib, margins elevated, upper surface granulated, of a fine green colour, often purple when exposed to the sun, especially about the margin, and the underside is generally of a dark purple hue. Female receptacles at first roundish, then hemispherical, barbate beneath, divided into from four to six laciniæ at the margin, standing on short peduncles, which are totally destitute of any bracts or membranes at their base (fig. 190). Cells of the receptacle rarely seven, eight, or nine, with a vertical opening, bivalved, margins involute. Perianth none. Capsules for the most part solitary, never emergent, but sessile in the cells. Male receptacles purple brown, roundish, marginate, plane above, sessile, immersed in the frond.



190.

Sometimes confounded with *Preissia commutata*, but easily distinguished by the absence of the four-lobed cruciate crest.

GENUS 45. DUMORTIERA, *Nees.*

Fronds thin, almost without pores or scales. Peduncles terminal, elongated, two-channelled. Capitulum orbicular, 2-8 lobed, often hairy. Involucre one-flowered, two-lipped at the apex. Calyptra persistent. Capsule stipitate, deeply cut in four to eight segments. Andræcium shortly pedunculate.

Dumortiera irrigua, *Wils.*

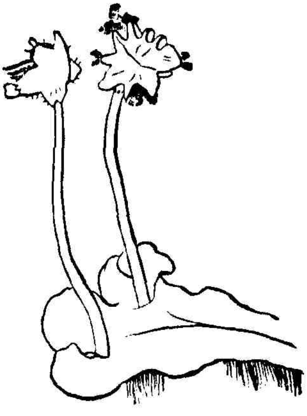
Fronds of a wavy dark-green, of close texture, without pores. Male receptacle stalked, flattish. Female receptacles hemispherical, five and six rayed, each ray slightly split.

Hygropyla irrigua, Tayl. Linn. Trans. XVII., 390; Mack. Hip. II., 54. *Marchantia irrigua,* Hook. Br. Fl. V., p. 106. *Dumortiera irrigua,* Nees Hep. 159; Cooke Hep. f. 189; Carr. and Pears. Exs. 285, 286.

In dripping place. (Fr. April, May.)

Fronds 1 to 5 inches long, about 1 inch broad, membranaceous-fleshy, procumbent, bilobed, margin of the lobes elevated, slightly undulate, rounded, bright green, tawny when old, one-nerved, eporose, attached by fibrils along the nerve. Fructification dioicous mostly, sometimes monoicous. Male receptacle plane above, granulate, circular, depressed in the centre, hemispherical beneath,

hispid at the margin with short straight setæ, enclosing numerous ovate cellules, peduncle scarcely as long as the diameter of the receptacle, striate, two-channelled. Female receptacle at first covered with an indusium of linear scales; when fertile pedunculate, upper surface irregular, here and there depressed, undulate, margin elevated, divided beneath into numerous cells, beset with short setæ (fig. 191). Fertile cells opening vertically by a small fissure, and the globose pedicellate capsule is extruded. Capsule splitting in four or six unequal valves; calyptra ruptured, leaving the remains at the base of the pedicel; proper perianth none.



191.

Genus 46. FEGATELLA, *Raddi.*

Female receptacle pedunculate, containing from four to nine cells, opening by a vertical fissure; calyces none; calyptra at length ruptured in the cell. Male receptacle sessile on the fronds, discoid. Vegetation frondose, dichotomous.

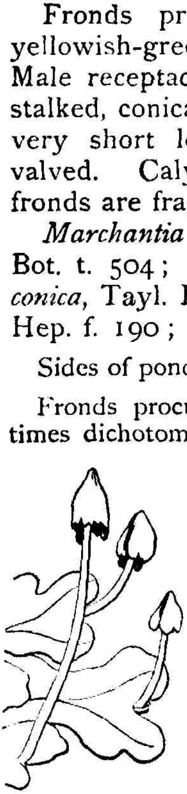
Fegatella conica, *Corda.*

Fronds prostrate, several times forked, yellowish-green. Midrib prominent beneath. Male receptacle sessile. Female receptacle stalked, conical, with the margins cut into six very short lobes. Involucres green, two-valved. Calyx four-toothed. The bruised fronds are fragrant, resembling bergamot.

Marchantia conica, Linn. Sp. 1604; Eng. Bot. t. 504; Hook. Br. Fl. V. 103. *Fegatella conica,* Tayl. Linn. Trans. XVII., 382; Cooke Hep. f. 190; Carr. and Pears. Exs. 57, 58.

Sides of ponds and shady banks. (Fr. March.)

Fronds procumbent, 3 to 5 inches long, several times dichotomous, segments oblong, obtuse, margins scarcely waved or crenate, colour uniform yellowish-green, rather fleshy than membranaceous. Midrib scarcely distinguishable on the upper surface, but by a longitudinal depression, prominent beneath, thickly covered with fibrous radicles, amongst which, on each side the midrib, a few membranous oblique scales; occasionally similar scales overlap the margin of the innovations at the end. These scales unequally bilobed at their anterior margin. Dioicous. Male receptacle sessile, arising from the midrib. Female receptacle pedunculate, peduncle



192.

succulent, inserted in a concave disc, receptacle conical, inclining to ovate, obtuse at the apex, margins deflexed, and cut into about six short emarginate lobes (fig. 192). Involucres green, bivalved. Calyx quadrifid, enclosing one ovate capsule, which is partially exserted, and cut into several revolute segments. Elaters bispiral.

GENUS 47. TARGIONIA, *Micheli.*

Distinct female receptacle none. Involucre springing from beneath the apex of the frond, two-valved, one fruited. Pistillidia three to four, of which one is perfected. Perianth none. Calyptra thin, persistent, investing the capsule, at length vanishing at the apex. Capsule shortly pedicellate, torn, or frustulate. Elaters two or three spired. Male receptacle lateral, discoid, papillose, seated on a proper innovation from the ventral rib.

Targionia hypophylla, *Linn.*

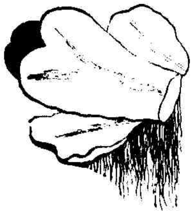
Fronds forming large patches, overlapping and flat, very deep green, purplish at the edges, oblong, with numerous radicles on the under surface. Fruit originating from the underside of the frond, near the extremity (fig. 193). Capsule never elevated beyond the globose calyx, splitting into several unequal segments.

Targionia hypophylla, Linn. Sp. 1604; Eng.

Bot. t. 287; Hook. Br. Fl. V., 101; Carr. and Pears. Ex. No. 64. *Targionia Michelii,* Nees Hep. IV., 299; Cooke Hep. (fig 192.).

On banks, in moist situations. (Fr. Apr. May.)

Fronds forming large patches, imbricated, oblong-ovate, plane, between coriaceous and fleshy, margin entire, very deep green, purplish at the edges, furnished with numerous oval pores on the upper surface, beneath is the appearance of a midrib, prominent, and covered with numerous radicles, having on each side many purple, transversely oblong, scales. Immediately beneath the extremity, or underside of the frond, is a solitary perianth, globose, of a purplish-black colour, marked with a vertical prominent line, where it dehisces and becomes two-valved (fig. 193). Within this perianth are at first a few pistillidia, one of which becomes fertile, covered with a calyptra, which latter at length splits irregularly. The spherical capsule is protruded, but never extends beyond the perianth. Fruit-stalk very short. Capsule dark brown, opening with several unequal segments. Elaters bispiral.



193.

Sub-order 3. RICCIACEÆ.

Vegetation frondose. Fruit without valves, for the most part immersed in the frond.

Capsule dehiscing irregularly. Elaters absent. Antheridia immersed in the frond.

The British genera may be thus characterised :—

A. Without a proper involucre :—

Capsule immersed in the upper side of the frond.—*Riccia.*

Capsule adnate to the inferior surface.—*Ricciella.*

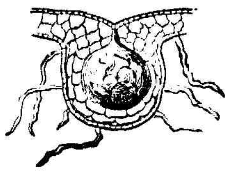
Capsule immersed in the frond, not protuberant.—*Ricciocarpus.*

B. With a proper involucre :—

Fruit free on the disc of the frond.—*Sphærocarpus.*

GENUS 48. RICCIA, *Mich.*

Involucre none. Fruit immersed in the frond. Calyptra style-bearing, style deciduous. Sporangium globose, irregularly erumpent. Elaters none. Antheridia naked on the superficies of the frond, tubulous, produced on the same or on other individuals.



194

" Capsule sphærical, immersed in the frond, indehiscent, crowned with a style, which alone is protruded."

Riccia glauca, *Linn.*

Frond dichotomously divided, substellate; laciniæ obovately-linear, emarginate, bilobate, plane, channelled at the apex, punctate; margin membranaceous, of the same colour beneath.

Riccia glauca, Linn. Sp. 1605; Eng. Bot. t. 2546; Lindenb. Mon. p. 417, t. 19; Cooke Hep. fig. 197; Carr. and Pears. Exs. No. 138. *Riccia crystallina* α, Hook. Eng. Fl. V., i., p. 98.

In glaucous green tufts, on moist ground. (Fr. Spring.)

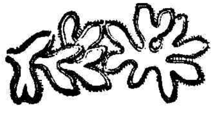
var. α *major*, Roth. Frond radiate, laciniæ obovate or obcordate, rather bilobate, crenate at the apex, extremities plane or channelled.—Lind. Mon. t. xix., f. 12, 13.

Lichen minor, Dillw. Musc. 533, t. 78, f. 10.

var. β *minor*, Lind. Frond and lobes somewhat triangular, sulcate.—Lind. Mon. t. xix. (figs. 14, 15).

Lichen minor, Dillw. Musc. 533, t. 78, f. 13.

Fronds forming roundish patches, conspicuous by their glaucous hue. Of a thick rather fleshy substance, and firmly fixed to the soil by fibrous radicles (fig. 195). Fruit disposed beneath the surface, in furrows radiating from the centre of the frond, and running along



195.

the middle of each lobe and segment, when ripe they rupture the cuticle, and the minute spores are copiously ejected.

Riccia bifurca, *Hoffm.*

Frond tumid, flabellate, dichotomously divided, laciniæ elliptic-obovate, or wedge-shaped, emarginate, bilobate, lobes divergent, punctate, margin thickened, elevated, rounded, broadly sulcate, purplish beneath. Disc nearly plane, glaucous green.

Riccia bifurca, Hoffm. Fl. Germ. 95; Lindenb. Mon. 425, t. xx., f. 1; Carr. in Grev. II., 88.

On limestone rocks, &c., in patches 2 to 3 inches in diameter.

Segments of the fronds three to six lines long, one line broad, contracted at each end, and spathulate, with a bold tumid border, most conspicuous near the apex. Rootlets numerous. Sporangia scattered irregularly over the disc. Spores three-angled, dark brown, reticulately muricate.—(*Plate 6, fig. 79.*)

Riccia crystallina, *Linn.*

Frond oblong, two-lobed, forked, the divisions reversely heart-shaped, margin rather crenate, of the same colour beneath. Surface

broken up by deep pits communicating with the air-cavities. Larger and lighter coloured than *R. glauca.*

Riccia crystallina, Linn. Sp. 1605; Cooke Hep. fig. 200; Lindenb. Mon. 437, t. xxii., fig. 2.

On banks and hedges on damp mould.

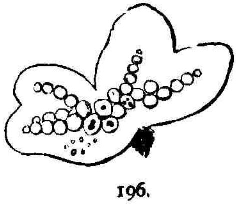
var. α *vulgaris.* Fronds less deeply cut, lobes obcordate, margin rather elevated, crenate.

Riccia pellucida, Hoffm. Germ. 96.—(*Plate* 7, *fig.* 94).

var. β *palustris.* Fronds with linear laciniæ, apex less dilated, crenulately emarginate.

Riccia crystallina β, Hook. Musc. Brit. 212; Eng. Fl. V., 1, p. 98; Lind. Mon. t. xxii., fig. 2. No. 9. *Lichen palustris*, Dill. Musc. 355, t. 78, f. 12.—(*Plate* 7, *fig.* 94*b.*)

Grows in more shady and moist situations than *R. glauca*, has the frond generally longer, broader, and much thinner, nearly plane, with the segments more numerous, and very obtuse, colour by no means glaucous, rather perhaps inclining to yellowish green.



196.

Fronds in orbicular tufts radiating from the centre, when fresh of a remarkably crystalline appearance.

Riccia glaucescens, *Carr.*

Frond flabellate-furcate, segments linear, wedge-shaped, concave, with rather a broad border, margins thinner, fringed with small translucent cells, not channelled above, pale glaucous, apex emarginate; under surface purplish.

Riccia glaucescens, Carr. in Carr. and Pears. Exs. No. 66.

On moist ground.

Dioicous. Fronds flabellate-furcate, sometimes crowded and imbricate, segments linear, cuneate, or battledore-shaped, concave, not channelled on the upper side, surrounded by a rather broad border, recurved and convex when moist, inflexed when dry, texture homogeneous, composed of large cells, arranged in regular series, thickened along the mid line of the lower surface; margins thinner, acute, fringed with small but strong translucent cells, sometimes wanting or irregularly disposed, and the border simply crenulate. Apex of the fronds emarginate, lobes connivent, connected at the base by a lunate fold, between which there is often a small central tongue proceeding from the inferior lobe of the frond. Colour pale translucent, glaucous green above, border somewhat paler, under surface covered laterally by a delicate membrane, or detached scales of a purple colour. Capsules few, occupying the hollow central channel near the base of the frond. Spores large, dark brown, muriculate.—(*Plate 7, fig. 87.*)

Riccia sorocarpa, *Bisch.*

Segments of the frond linear, subdichoromous, carinate-sulcate, green on both surfaces; lobes thick and fleshy, oblong, obtuse, or emarginate; margin thin, glabrous, inflexed when dry; fruit scattered along the mid-vein.

Riccia sorocarpa, Bisch. Hep. Nov. Act. N. Cur. XVII., p. 1053, t. 71, f. 11; Gott. and Rabh. Exs. 23, 543; Carr. in Grevillea, II., p. 88; Carr. and Pears. Exs. No. 139; Braith. Grevillea, I., p. 144.

On limestone rocks and moist walls.

Fronds forming shallow strata, crowded and entangled, so as to be separated with difficulty; colour pale glaucous green. Segments one to three lines long, one-quarter to one-third line broad. Pistillidia scattered along the carinate base of the lobes, young fruit immersed, at length elevating the epidermis, which it ruptures to allow the escape of the spores.

Spores smaller than in *R. bifurca*, dark brown, crenate-reticulate.—(*Plate 6, fig. 80.*)

Riccia tumida, *Lindenb.*

Frond nearly simple, oblong-linear, obtuse, thickened about the apex beneath, and at the margin, above channelled, below purplish; the margin singly, the apex doubly ciliate.

Riccia tumida, Linden. Mon. 459, t. xxvii., fig. 2; Carr. and Pears. Exs. No. 67.

Frond two to three lines long.—(*Plate* 7, *fig.* 92.)

This may be recognised amongst British species, with a purplish under surface, by the ciliated margin, in which respect it differs from *R. nigrella*, as well as in its thicker substance.

Riccia nigrella, *De Cand.*

Frond dichotomous; laciniæ linear, channelled; margin membranaceous, quite entire, dark purple beneath; transversely scaly, scales semi-circular, not exceeding the margin.

Riccia nigrella, De Cand, Fl. Fr. V., p. 193; Lind. Mon. p. 467, t. xxix., fig. 1; Carr. and Pears. Exs. 65, 290. *Riccia lamellosa*, Ralfs. Cooke Hep. No. 133.

On damp banks.

Small in all its parts, with linear dichotomous lobes, margin membranous, entire, expanded, and dark green when moist, but when dry remarkably inflexed, and displaying the dark purple scales which clothe the lower surface, and which are rounded and closely imbricate.—(*Plate* 6, *fig.* 81.)

SUB-GENUS 1. RICCIOCARPUS, *Corda.*

Fruit immersed in the frond, and protu-

berant on the surface, at length naked, by the splitting of the middle groove; substance geminate.—*Corda in Opiz. Nat.* (1829).

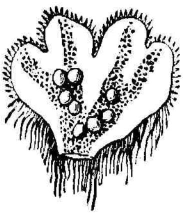
Ricciocarpus natans, *C.*

Frond simple, or with innovations, about ½ inch long, pale green above, slightly grooved in the centre, inversely heart-shaped, purple beneath and clothed, especially at the edge, with numerous long pendent fringe-like flattened serrated hairs.

Riccia natans, Linn. Syst. 956; Hook. Musc. Brit. 214; Bot. Misc., p. 41, t. 22; Eng. Fl. V., i., p. 99; Cooke Hep. f. 199; Linden. Mon. 475, t. xxxi., xxxii. *Ricciocarpus natans*, Corda Sturm. XXII., XXIII., p. 103, t. 32; Carr. and Pears. Exs. No. 141. *Lichen parvus vernus, &c.*, Dill. Musc. 536, t. 78, f. 18; Ray's Syn. p. 116.

Floating on water. (Fr. Summer.)

The fronds float like duckweed, and are from ¼ to ½ inch long, pale green above, often tinged with purple towards the margin and beneath, slightly grooved along the centre of each lobe, rough with minute scales on the upper surface, and copiously fringed at the margin, and clothed beneath with long pendent flat membranaceous hairs (fig. 197).



197.

SUB-GENUS 2. **RICCIELLA**, *Braun.*

Fruit globose, exserted, adnate to the lower surface of the frond.—*Braun. Bot. Zeit.* 1821, p. 756.

Ricciella fluitans, *Br.*

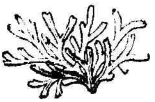
Frond dichotomous, ½ to 2 inches in length, yellowish green, repeatedly forked, laciniæ linear, narrow, obtusely emarginate, and forked at the apex, sometimes thickened, usually membranaceous, channelled, margin and beneath of the same colour.

Riccia fluitans, Linn. Sp. 1606; Eng. Bot. t. 251; Lindenb. Mon. t. xxix., xxv.; Hook. Musc. Britt. 213; Eng. Fl. V., i., p. 98; Cooke Hep. f. 198. *Ricciella fluitans*, Braun. Flora, 1821, p. 754; Lindenb. Syn. p. 115; Carr. and Pears. Exs. 140. *Lichenastrum aquaticum*, Dill. Musc. 514, t. 74, f. 47.

Floating on stagnant water.

var. β *canaliculata*, narrower, margin elevated, sulcate.

The fronds float on stagnant water, amongst duckweed, or occasionally root in the soil at the margin, when they are of a smaller size; of a yellowish-green colour, from 1 to 2 inches in length, the segments linear, but a little enlarged towards the apex, which is



198.

likewise occasionally marked with darkish spots (fig. 198).

GENUS 49. SPHÆROCARPUS, *Mich.*

Involucre none. Perianth pear-shaped, smooth, pierced at the apex, aggregated on the surface of the frond. Calyptra crowned with a deciduous style. Sporangium at length nearly free, globose, indehiscent; spores destitute of elaters.

Sphærocarpus terrestris, *Mich.*

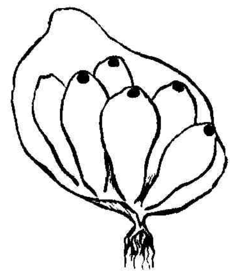
Fronds growing singly, or in patches $\frac{1}{4}$ to $\frac{1}{2}$ inch in length, flat, margin slightly lobed, thin, of a pale-green colour, adhering, by the underside, by means of numerous radicles, upper surface bearing the pear-shaped follicles.

Sphærocarpus terrestris, Mich. Nova. Gen. 4, t. 3; Dill. Musc. 536, t. 78, f. 17; Eng. Bot. t. 299; Hook. Musc. Britt. 215; Eng. Fl. V., i., p. 99; Carr. and Pears. Exs. No. 215; Linden. Mon. 496, t. xxxvi., fig. 1. *Sphærocarpus Michelii*, Bell. Act. Taur. V., 258; Cooke Hep. f. 195.

On the ground, especially clover fields.

Fronds growing singly, or collected in patches, on the ground, $\frac{1}{4}$ to $\frac{1}{2}$ inch long, plane, slightly waved, margin variously lobed, lobes short and rounded,

texture thin, reticulated, pale green somewhat glaucous, adhering by numerous fibrous radicles produced on the underside of the frond; superior surface, except towards the margin, covered with many obovate follicles of the same colour as the frond, variable in size, truncated at the top and perforated, with an entire aperture. Within these are sometimes two to five pistilliform bodies, at other times one of these is oblong, and swollen, or it may more rarely assume a spherical form (fig. 199).



199.

Sub-order 4. *ANTHOCEROTACEÆ.*

Vegetation frondose, soft. Fronds for the most part orbicular, margin more or less deeply lobed or incised. Fruit pedunculate, capsular, pod-like, mostly two-valved, with an axial filiform columella. Elaters present. Spores at first enclosed in tetrasporous utricles, then free.

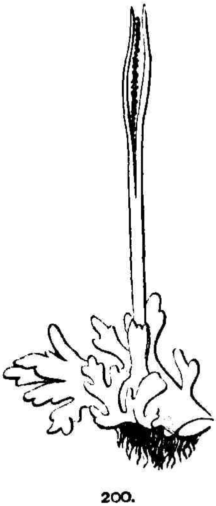
GENUS 50. **ANTHOCEROS,** *Mich.*

Fronds mostly orbicular, radiately lobate, nearly plane, or depressed in the centre, costa confluent and confused with both sides of frond. Monoicous or dioicous. Capsule pedunculate, exserted. Elaters undulate. Antheridia scattered without order on the frond.

Anthoceros punctatus, *Linn.*

Frond roundish, and lobed in a stellate manner, the lobes broad, and without nerves, flat, crisped at the edges. Involucre cylindrical.

Anthoceros punctatus, Linn. Sp. 1606; Eng. Bot. t. 1537; Hook. Musc. Brit. 216; Cooke Hep. fig. 194; Carr. and Pears. Exs. No. 210, 211.



200.

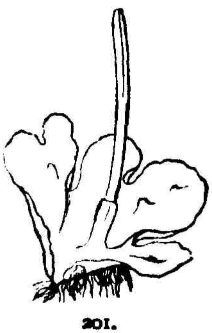
On clay or bare soil.

Fronds attached by fibrous radicles to the ground, and spreading in a circular manner, the centre depressed, and concave, their margin lobed and more or less deeply sinuated or pinnatifid, the segments oblong and obtuse. Colour bright shining green, several dots appear on the surface which are the male flowers, in the form of black imbedded warts, with a torn margin. The capsules arise like blades of grass, each from a sheath, and are cylindrical, tipped with a veil when young, bursting when ripe into two valves, with a parallel partition (fig. 200)

Anthoceros lævis, *Linn.*

Larger than *A. punctatus.* Frond smooth and flat. Mouth of the involucre more broadly rough.

Anthoceros lævis, Linn. Sp. 1606; Lindenb. Syn. Hepat. 113; Cooke Hep. fig. 193; Carr. and Pears. Exs. No. 212, 213; Eng. Bot. t. 1538.



201.

On wet slopes, sides of ditches, &c.

Fronds larger than in *A. punctatus,* lobed, the segments dilated, rounded, and waved; in *that* species they are round and entire, not sinuated. The colour in this species is darker green, and it is later in fruit (fig. 201).

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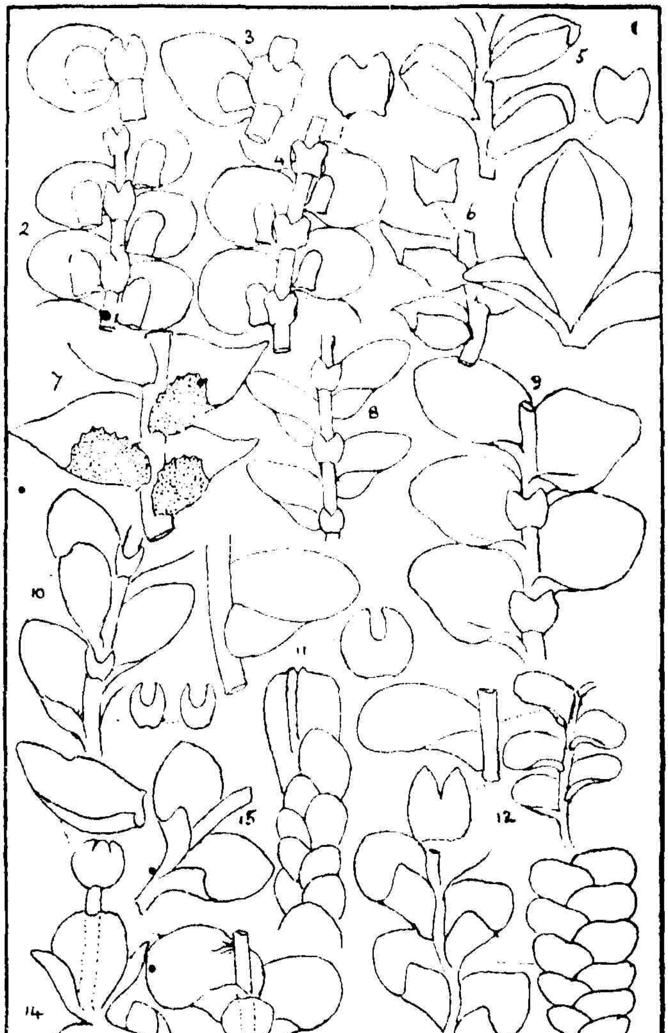
Plate 1.



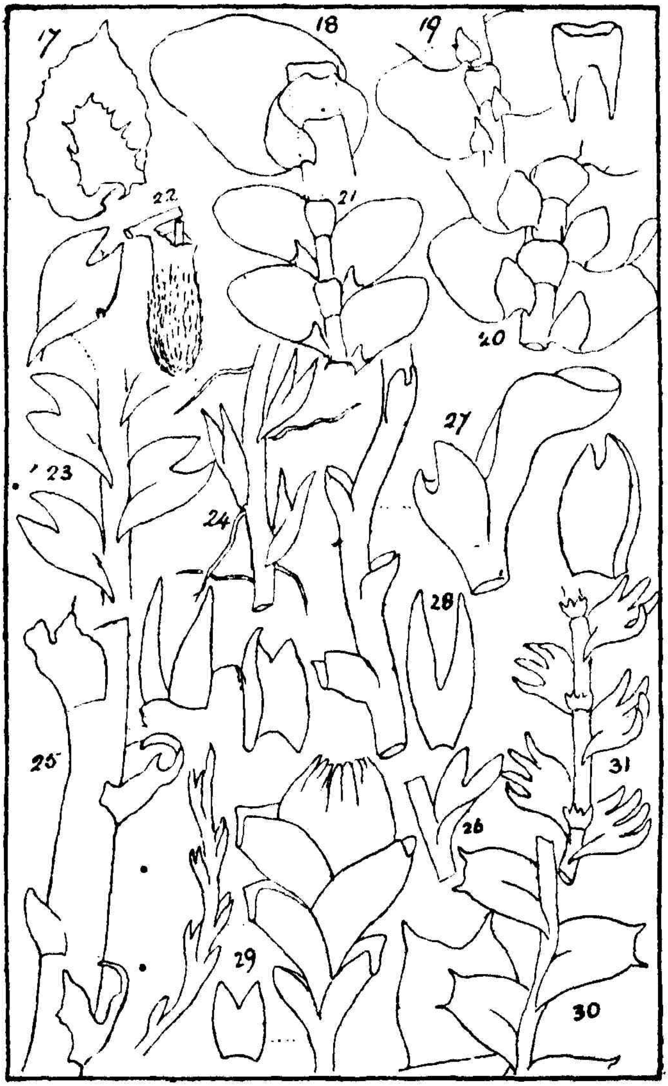

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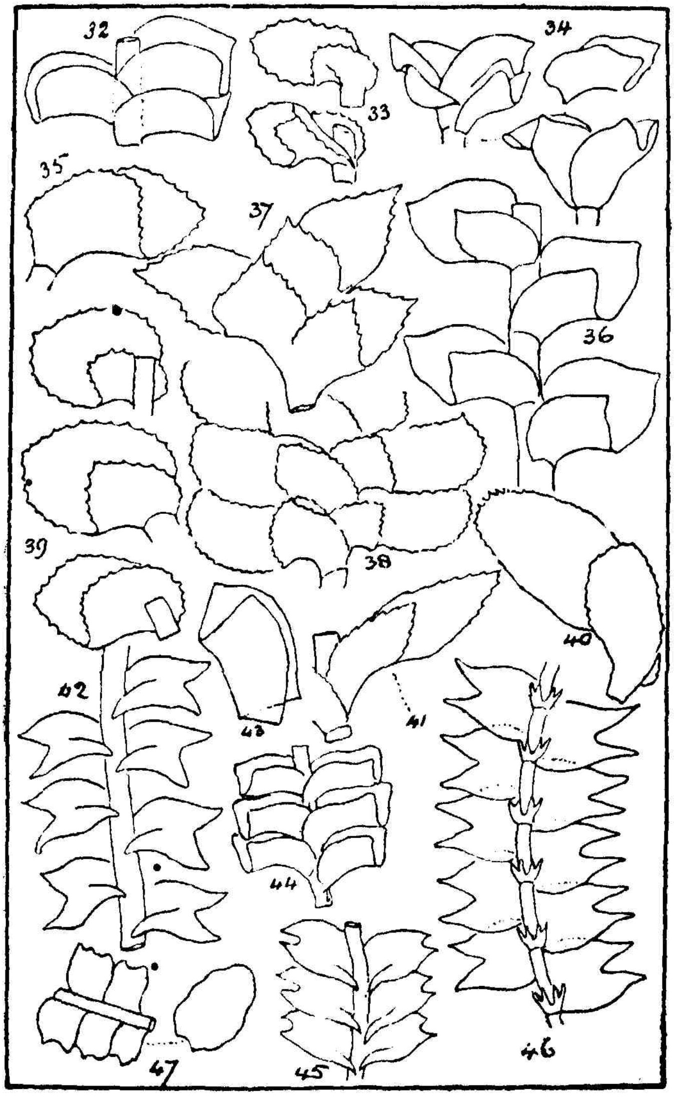
Plate 3.



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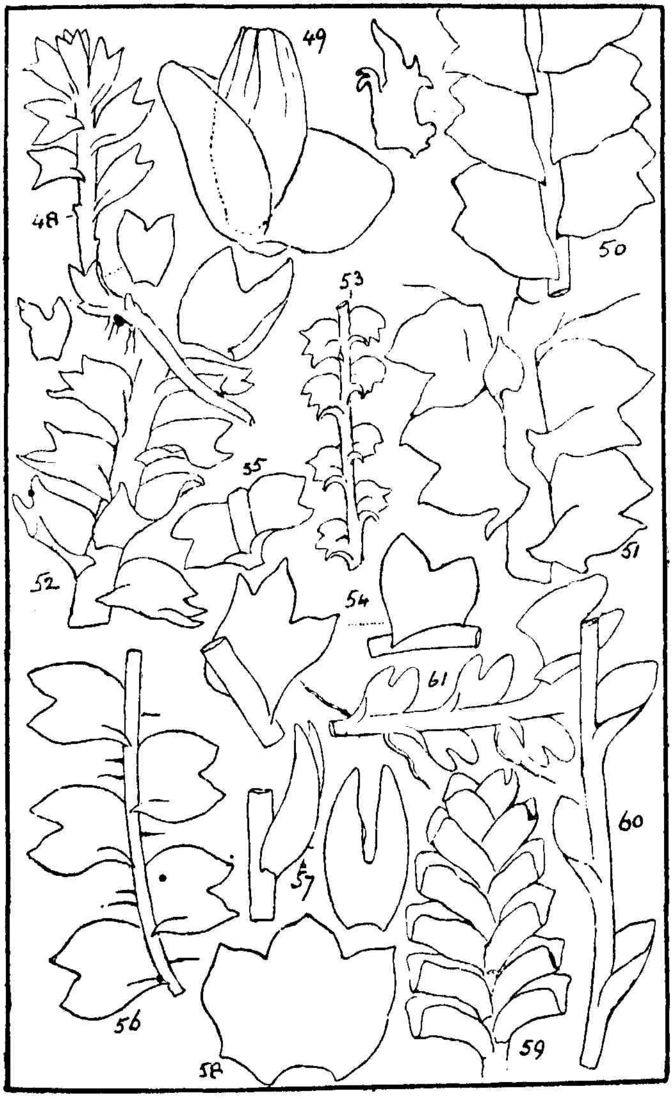

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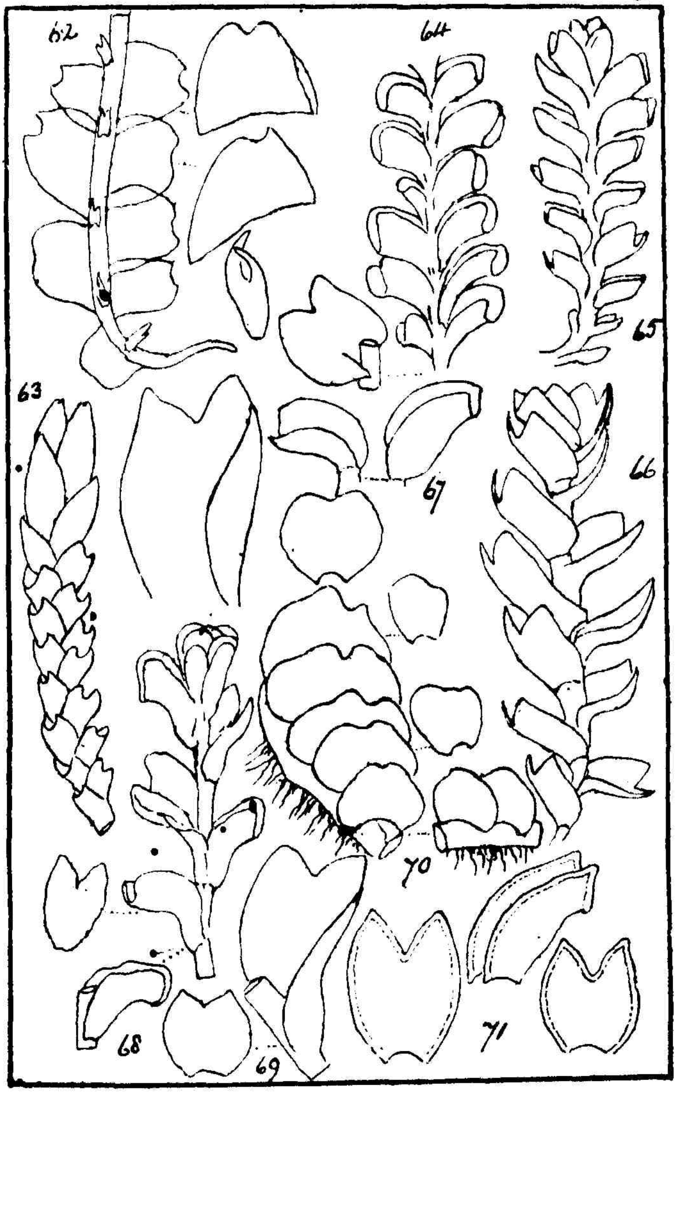

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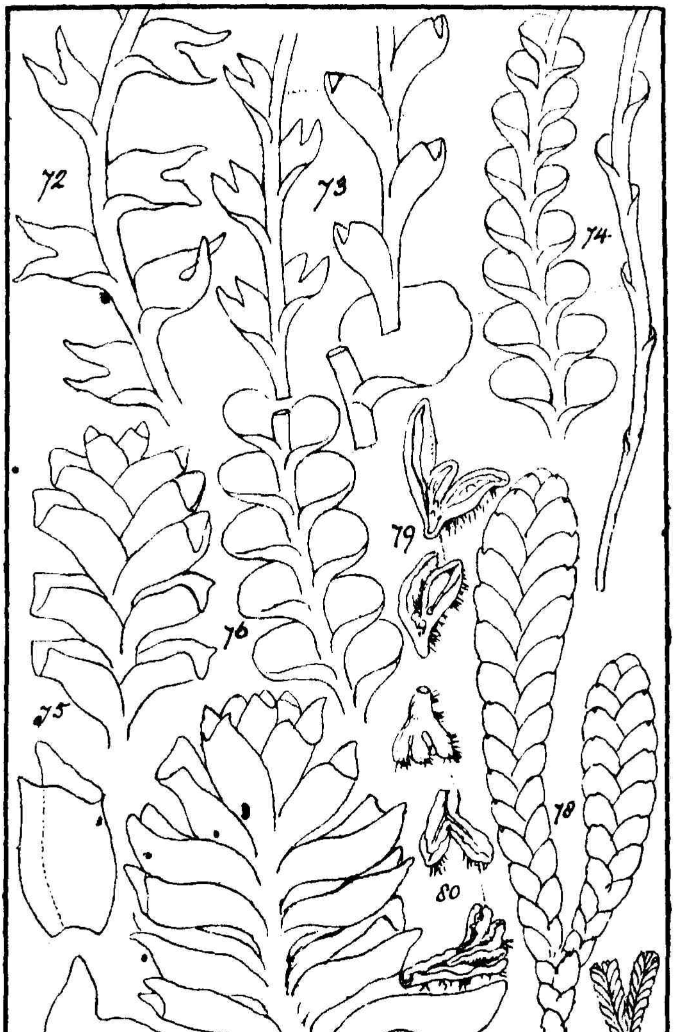
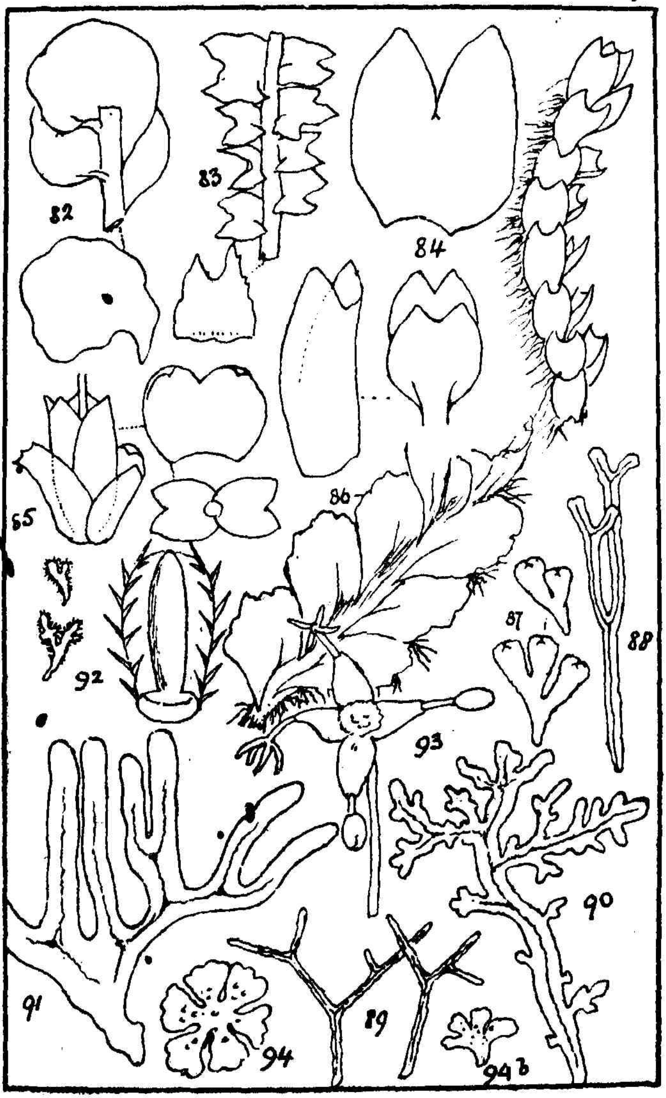
Plate 7.